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1 Howard collected fish eggs from a pond behind his house so he could determine whether sunlight had an effect on how many of the eggs hatched. After he collected the eggs, he divided them into two tanks. He put both tanks outside near the pond, and he covered one of the tanks with a box to block out all sunlight. State whether Howard's investigation was an example of a controlled experiment, an observation, or a survey. Justify your response.

2 Which task is not a component of an observational study?
   1. The researcher decides who will make up the sample.
   2. The researcher analyzes the data received from the sample.
   3. The researcher gathers data from the sample, using surveys or taking measurements.
   4. The researcher divides the sample into two groups, with one group acting as a control group.

3 A doctor wants to test the effectiveness of a new drug on her patients. She separates her sample of patients into two groups and administers the drug to only one of these groups. She then compares the results. Which type of study best describes this situation?
   1. census
   2. survey
   3. observation
   4. controlled experiment

4 A market research firm needs to collect data on viewer preferences for local news programming in Buffalo. Which method of data collection is most appropriate?
   1. census
   2. survey
   3. observation
   4. controlled experiment

5 A school cafeteria has five different lunch periods. The cafeteria staff wants to find out which items on the menu are most popular, so they give every student in the first lunch period a list of questions to answer in order to collect data to represent the school. Which type of study does this represent?
   1. observation
   2. controlled experiment
   3. population survey
   4. sample survey

6 A survey completed at a large university asked 2,000 students to estimate the average number of hours they spend studying each week. Every tenth student entering the library was surveyed. The data showed that the mean number of hours that students spend studying was 15.7 per week. Which characteristic of the survey could create a bias in the results?
   1. the size of the sample
   2. the size of the population
   3. the method of analyzing the data
   4. the method of choosing the students who were surveyed

7 The yearbook staff has designed a survey to learn student opinions on how the yearbook could be improved for this year. If they want to distribute this survey to 100 students and obtain the most reliable data, they should survey
   1. every third student sent to the office
   2. every third student to enter the library
   3. every third student to enter the gym for the basketball game
   4. every third student arriving at school in the morning
A2.S.3: AVERAGE KNOWN WITH MISSING DATA

8 The number of minutes students took to complete a quiz is summarized in the table below.

<table>
<thead>
<tr>
<th>Minutes</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>5</td>
<td>3</td>
<td>x</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

If the mean number of minutes was 17, which equation could be used to calculate the value of x?

1 \[ 17 = \frac{119 + x}{x} \]
2 \[ 17 = \frac{119 + 16x}{x} \]
3 \[ 17 = \frac{446 + x}{26 + x} \]
4 \[ 17 = \frac{446 + 16x}{26 + x} \]

9 The table below displays the results of a survey regarding the number of pets each student in a class has. The average number of pets per student in this class is 2.

<table>
<thead>
<tr>
<th>Number of Pets</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>k</td>
<td>2</td>
</tr>
</tbody>
</table>

What is the value of k for this table?

1 9
2 2
3 8
4 4

A2.S.4: DISPERSION

10 The scores of one class on the Unit 2 mathematics test are shown in the table below.

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>92</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>76</td>
<td>6</td>
</tr>
<tr>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>2</td>
</tr>
</tbody>
</table>

Find the population standard deviation of these scores, to the nearest tenth.

11 The table below shows the first-quarter averages for Mr. Harper’s statistics class.

<table>
<thead>
<tr>
<th>Statistics Class Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter Averages</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>99</td>
</tr>
<tr>
<td>97</td>
</tr>
<tr>
<td>95</td>
</tr>
<tr>
<td>92</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>87</td>
</tr>
<tr>
<td>84</td>
</tr>
<tr>
<td>81</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>65</td>
</tr>
</tbody>
</table>

What is the population variance for this set of data?

1 8.2
2 8.3
3 67.3
4 69.3
12 During a particular month, a local company surveyed all its employees to determine their travel times to work, in minutes. The data for all 15 employees are shown below.

\[
\begin{array}{cccccccc}
25 & 55 & 40 & 65 & 29 \\
45 & 59 & 35 & 25 & 37 \\
52 & 30 & 8 & 40 & 55 \\
\end{array}
\]

Determine the number of employees whose travel time is within one standard deviation of the mean.

13 The heights, in inches, of 10 high school varsity basketball players are 78, 79, 79, 72, 75, 71, 74, 74, 83, and 71. Find the interquartile range of this data set.

14 Ten teams competed in a cheerleading competition at a local high school. Their scores were 29, 28, 39, 37, 45, 40, 41, 38, 37, and 48. How many scores are within one population standard deviation from the mean? For these data, what is the interquartile range?

15 The following is a list of the individual points scored by all twelve members of the Webster High School basketball team at a recent game:

\[
2 \ 2 \ 3 \ 4 \ 6 \ 7 \ 9 \ 10 \ 10 \ 11 \ 12 \ 14
\]

Find the interquartile range for this set of data.

16 Samantha constructs the scatter plot below from a set of data.

Based on her scatter plot, which regression model would be most appropriate?
1 exponential
2 linear
3 logarithmic
4 power

17 The table below shows the results of an experiment involving the growth of bacteria.

<table>
<thead>
<tr>
<th>Time (x) (in minutes)</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Bacteria (y)</td>
<td>2</td>
<td>25</td>
<td>81</td>
<td>175</td>
<td>310</td>
<td>497</td>
</tr>
</tbody>
</table>

Write a power regression equation for this set of data, rounding all values to three decimal places. Using this equation, predict the bacteria’s growth, to the nearest integer, after 15 minutes.
18 The table below shows the number of new stores in a coffee shop chain that opened during the years 1986 through 1994.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of New Stores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>14</td>
</tr>
<tr>
<td>1987</td>
<td>27</td>
</tr>
<tr>
<td>1988</td>
<td>48</td>
</tr>
<tr>
<td>1989</td>
<td>80</td>
</tr>
<tr>
<td>1990</td>
<td>110</td>
</tr>
<tr>
<td>1991</td>
<td>153</td>
</tr>
<tr>
<td>1992</td>
<td>261</td>
</tr>
<tr>
<td>1993</td>
<td>403</td>
</tr>
<tr>
<td>1994</td>
<td>681</td>
</tr>
</tbody>
</table>

Using $x = 1$ to represent the year 1986 and $y$ to represent the number of new stores, write the exponential regression equation for these data. Round all values to the nearest thousandth.

19 A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

<table>
<thead>
<tr>
<th>Time, hrs $(x)$</th>
<th>Number of Organisms $(y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>10</td>
<td>104</td>
</tr>
<tr>
<td>12</td>
<td>142</td>
</tr>
<tr>
<td>16</td>
<td>260</td>
</tr>
</tbody>
</table>

Determine the exponential regression equation model for these data, rounding all values to the nearest ten-thousandth. Using this equation, predict the number of single-celled organisms, to the nearest whole number, at the end of the 18th hour.

20 A cup of soup is left on a countertop to cool. The table below gives the temperatures, in degrees Fahrenheit, of the soup recorded over a 10-minute period.

<table>
<thead>
<tr>
<th>Time in Minutes $(x)$</th>
<th>Temperature in °F $(y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>180.2</td>
</tr>
<tr>
<td>2</td>
<td>165.8</td>
</tr>
<tr>
<td>4</td>
<td>146.3</td>
</tr>
<tr>
<td>6</td>
<td>135.4</td>
</tr>
<tr>
<td>8</td>
<td>127.7</td>
</tr>
<tr>
<td>10</td>
<td>110.5</td>
</tr>
</tbody>
</table>

Write an exponential regression equation for the data, rounding all values to the nearest thousandth.
21 The data collected by a biologist showing the growth of a colony of bacteria at the end of each hour are displayed in the table below.

<table>
<thead>
<tr>
<th>Time, hour, (x)</th>
<th>Population (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>330</td>
</tr>
<tr>
<td>2</td>
<td>580</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1650</td>
</tr>
<tr>
<td>5</td>
<td>3000</td>
</tr>
</tbody>
</table>

Write an exponential regression equation to model these data. Round all values to the nearest thousandth. Assuming this trend continues, use this equation to estimate, to the nearest ten, the number of bacteria in the colony at the end of 7 hours.

A2.S.8: CORRELATION COEFFICIENT

22 Which value of \(r\) represents data with a strong negative linear correlation between two variables?
1. \(-1.07\)
2. \(-0.89\)
3. \(-0.14\)
4. \(0.92\)

23 Which calculator output shows the strongest linear relationship between \(x\) and \(y\)?

1. \(r = 0.8643\)
2. \(r = 0.8361\)
3. \(r = 0.6022\)
4. \(r = -0.8924\)
24 As shown in the table below, a person’s target heart rate during exercise changes as the person gets older.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Target Heart Rate (beats per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>135</td>
</tr>
<tr>
<td>25</td>
<td>132</td>
</tr>
<tr>
<td>30</td>
<td>129</td>
</tr>
<tr>
<td>35</td>
<td>125</td>
</tr>
<tr>
<td>40</td>
<td>122</td>
</tr>
<tr>
<td>45</td>
<td>119</td>
</tr>
<tr>
<td>50</td>
<td>115</td>
</tr>
</tbody>
</table>

Which value represents the linear correlation coefficient, rounded to the nearest thousandth, between a person’s age, in years, and that person’s target heart rate, in beats per minute?

1. \(-0.999\)
2. \(-0.664\)
3. \(0.998\)
4. \(1.503\)

25 The relationship between \(t\), a student’s test scores, and \(d\), the student’s success in college, is modeled by the equation \(d = 0.48t + 75.2\). Based on this linear regression model, the correlation coefficient could be

1. between \(-1\) and 0
2. between 0 and 1
3. equal to \(-1\)
4. equal to 0

26 Which value of \(r\) represents data with a strong positive linear correlation between two variables?

1. \(0.89\)
2. \(0.34\)
3. \(1.04\)
4. \(0.01\)

27 The lengths of 100 pipes have a normal distribution with a mean of 102.4 inches and a standard deviation of 0.2 inch. If one of the pipes measures exactly 102.1 inches, its length lies

1. below the 16th percentile
2. between the 50th and 84th percentiles
3. between the 16th and 50th percentiles
4. above the 84th percentile

28 An amateur bowler calculated his bowling average for the season. If the data are normally distributed, about how many of his 50 games were within one standard deviation of the mean?

1. 14
2. 17
3. 34
4. 48

29 Assume that the ages of first-year college students are normally distributed with a mean of 19 years and standard deviation of 1 year. To the nearest integer, find the percentage of first-year college students who are between the ages of 18 years and 20 years, inclusive. To the nearest integer, find the percentage of first-year college students who are 20 years old or older.

30 In a study of 82 video game players, the researchers found that the ages of these players were normally distributed, with a mean age of 17 years and a standard deviation of 3 years. Determine if there were 15 video game players in this study over the age of 20. Justify your answer.

31 If the amount of time students work in any given week is normally distributed with a mean of 10 hours per week and a standard deviation of 2 hours, what is the probability a student works between 8 and 11 hours per week?

1. 34.1%
2. 38.2%
3. 53.2%
4. 68.2%
32 In a certain high school, a survey revealed the mean amount of bottled water consumed by students each day was 153 bottles with a standard deviation of 22 bottles. Assuming the survey represented a normal distribution, what is the range of the number of bottled waters that approximately 68.2% of the students drink?
1 131 – 164
2 131 – 175
3 142 – 164
4 142 – 175

33 Liz has applied to a college that requires students to score in the top 6.7% on the mathematics portion of an aptitude test. The scores on the test are approximately normally distributed with a mean score of 576 and a standard deviation of 104. What is the minimum score Liz must earn to meet this requirement?
1 680
2 732
3 740
4 784

36 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word PENNSYLVANIA.

37 A four-digit serial number is to be created from the digits 0 through 9. How many of these serial numbers can be created if 0 can not be the first digit, no digit may be repeated, and the last digit must be 5?
1 448
2 504
3 2,240
4 2,520

38 How many different six-letter arrangements can be made using the letters of the word “TATTOO”?
1 60
2 90
3 120
4 720

39 Find the number of possible different 10-letter arrangements using the letters of the word “STATISTICS.”

40 Which expression represents the total number of different 11-letter arrangements that can be made using the letters in the word “MATHEMATICS”?
1 \(\frac{11!}{3!}\)
2 \(\frac{11!}{2! \cdot 2! \cdot 2!}\)
3 \(\frac{11!}{8!}\)
4 \(\frac{11!}{2! \cdot 2! \cdot 2!}\)

41 The principal would like to assemble a committee of 8 students from the 15-member student council. How many different committees can be chosen?
1 120
2 6,435
3 32,432,400
4 259,459,200

**PROBABILITY**

**A2.S.10: PERMUTATIONS**

34 Which formula can be used to determine the total number of different eight-letter arrangements that can be formed using the letters in the word DEADLINE?
1 \(8!\)
2 \(\frac{8!}{4!}\)
3 \(\frac{8!}{2! \cdot 2!}\)
4 \(\frac{8!}{2! + 2!}\)

35 The letters of any word can be rearranged. Carol believes that the number of different 9-letter arrangements of the word “TENNESSEE” is greater than the number of different 7-letter arrangements of the word “VERMONT.” Is she correct? Justify your answer.
42 Ms. Bell's mathematics class consists of 4 sophomores, 10 juniors, and 5 seniors. How many different ways can Ms. Bell create a four-member committee of juniors if each junior has an equal chance of being selected?
1 210
2 3,876
3 5,040
4 93,024

43 A blood bank needs twenty people to help with a blood drive. Twenty-five people have volunteered. Find how many different groups of twenty can be formed from the twenty-five volunteers.

44 If order does not matter, which selection of students would produce the most possible committees?
1 5 out of 15
2 5 out of 25
3 20 out of 25
4 15 out of 25

A2.S.9: DIFFERENTIATING BETWEEN PERMUTATIONS AND COMBINATIONS

45 Twenty different cameras will be assigned to several boxes. Three cameras will be randomly selected and assigned to box A. Which expression can be used to calculate the number of ways that three cameras can be assigned to box A?
1 20!
2 \( \frac{20!}{3!} \)
3 \( 20C_3 \)
4 \( 20P_3 \)

46 Three marbles are to be drawn at random, without replacement, from a bag containing 15 red marbles, 10 blue marbles, and 5 white marbles. Which expression can be used to calculate the probability of drawing 2 red marbles and 1 white marble from the bag?
1 \( \frac{15C_2 \cdot 5C_1}{30C_3} \)
2 \( \frac{15P_2 \cdot 5P_1}{30C_3} \)
3 \( \frac{15C_2 \cdot 5C_1}{30P_3} \)
4 \( \frac{15P_2 \cdot 5P_1}{30P_3} \)

47 There are eight people in a tennis club. Which expression can be used to find the number of different ways they can place first, second, and third in a tournament?
1 \( 8P_3 \)
2 \( 8C_3 \)
3 \( 8P_5 \)
4 \( 8C_5 \)

48 Which problem involves evaluating \( 6P_4 \)?
1 How many different four-digit ID numbers can be formed using 1, 2, 3, 4, 5, and 6 without repetition?
2 How many different subcommittees of four can be chosen from a committee having six members?
3 How many different outfits can be made using six shirts and four pairs of pants?
4 How many different ways can one boy and one girl be selected from a group of four boys and six girls?

49 A math club has 30 boys and 20 girls. Which expression represents the total number of different 5-member teams, consisting of 3 boys and 2 girls, that can be formed?
1 \( 30P_3 \cdot 20P_2 \)
2 \( 30C_3 \cdot 20C_2 \)
3 \( 30P_3 + 20P_2 \)
4 \( 30C_3 + 20C_2 \)
A2.S.12: SAMPLE SPACE

50 A committee of 5 members is to be randomly selected from a group of 9 teachers and 20 students. Determine how many different committees can be formed if 2 members must be teachers and 3 members must be students.

A2.S.13: GEOMETRIC PROBABILITY

51 A dartboard is shown in the diagram below. The two lines intersect at the center of the circle, and the central angle in sector 2 measures $\frac{2\pi}{3}$.

If darts thrown at this board are equally likely to land anywhere on the board, what is the probability that a dart that hits the board will land in either sector 1 or sector 3?

1 $\frac{1}{6}$
2 $\frac{1}{3}$
3 $\frac{1}{2}$
4 $\frac{2}{3}$

A2.S.15: BINOMIAL PROBABILITY

52 The members of a men’s club have a choice of wearing black or red vests to their club meetings. A study done over a period of many years determined that the percentage of black vests worn is 60%. If there are 10 men at a club meeting on a given night, what is the probability, to the nearest thousandth, that at least 8 of the vests worn will be black?

53 A study shows that 35% of the fish caught in a local lake had high levels of mercury. Suppose that 10 fish were caught from this lake. Find, to the nearest tenth of a percent, the probability that at least 8 of the 10 fish caught did not contain high levels of mercury.

54 The probability that the Stormville Sluggers will win a baseball game is $\frac{2}{3}$. Determine the probability, to the nearest thousandth, that the Stormville Sluggers will win at least 6 of their next 8 games.

55 The probability that a professional baseball player will get a hit is $\frac{1}{3}$. Calculate the exact probability that he will get at least 3 hits in 5 attempts.

56 A spinner is divided into eight equal sections. Five sections are red and three are green. If the spinner is spun three times, what is the probability that it lands on red exactly twice?

1 $\frac{25}{64}$
2 $\frac{45}{512}$
3 $\frac{75}{512}$
4 $\frac{225}{512}$
57. A study finds that 80% of the local high school students text while doing homework. Ten students are selected at random from the local high school. Which expression would be part of the process used to determine the probability that, at most, 7 of the 10 students text while doing homework?

1. \(10 \binom{4}{5} \left( \frac{1}{5} \right)^6 \left( \frac{4}{5} \right)^4\)
2. \(10 \binom{4}{5} \left( \frac{1}{5} \right)^7\)
3. \(10 \binom{7}{10} \left( \frac{3}{10} \right)^2\)
4. \(10 \binom{7}{10} \left( \frac{3}{10} \right)^1\)

58. On a multiple-choice test, Abby randomly guesses on all seven questions. Each question has four choices. Find the probability, to the nearest thousandth, that Abby gets exactly three questions correct.

59. Because Sam’s backyard gets very little sunlight, the probability that a geranium planted there will flower is 0.28. Sam planted five geraniums. Determine the probability, to the nearest thousandth, that at least four geraniums will flower.

ABSOLUTE VALUE

A2.A.1: ABSOLUTE VALUE EQUATIONS AND INEQUALITIES

60. What is the solution set of the equation \(|4a + 6| - 4a = -10|\)?

1. \(\emptyset\)
2. \(\{0\}\)
3. \(\left\{\frac{1}{2}\right\}\)
4. \(\left\{0, \frac{1}{2}\right\}\)

61. Which graph represents the solution set of \(|6x - 7| \leq 5|\)?

62. Graph the inequality \(-3|6 - x| < -15|\) for \(x\). Graph the solution on the line below.

63. Which graph represents the solution set of \(\left| \frac{4x - 5}{3} \right| > 1|\)?
64 Determine the solution of the inequality 
\[ |3 - 2x| \geq 7. \] [The use of the grid below is optional.]

65 What is the graph of the solution set of 
\[ |2x - 1| > 5? \]

1
2
3
4

66 Solve \((-4x + 5) < 13\) algebraically for \(x\).

**QUADRATICS**

A2.A.20-21: ROOTS OF QUADRATICS

67 Find the sum and product of the roots of the equation 
\[ 5x^2 + 11x - 3 = 0. \]

68 What are the sum and product of the roots of the equation 
\[ 6x^2 - 4x - 12 = 0? \]

1 sum = \(-\frac{2}{3}\); product = \(-2\)
2 sum = \(\frac{2}{3}\); product = \(-2\)
3 sum = \(-2\); product = \(\frac{2}{3}\)
4 sum = \(-2\); product = \(-\frac{2}{3}\)

69 Determine the sum and the product of the roots of 
\[ 3x^2 = 11x - 6. \]

70 Determine the sum and the product of the roots of the equation 
\[ 12x^2 + x - 6 = 0. \]

71 For which equation does the sum of the roots equal \(\frac{3}{4}\) and the product of the roots equal \(-2\)?

1 \(4x^2 - 8x + 3 = 0\)
2 \(4x^2 + 8x + 3 = 0\)
3 \(4x^2 - 3x - 8 = 0\)
4 \(4x^2 + 3x - 2 = 0\)

72 For which equation does the sum of the roots equal \(-3\) and the product of the roots equal \(2\)?

1 \(x^2 + 2x - 3 = 0\)
2 \(x^2 - 3x + 2 = 0\)
3 \(2x^2 + 6x + 4 = 0\)
4 \(2x^2 - 6x + 4 = 0\)

73 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is \(-27\).

74 Which equation has roots with the sum equal to \(\frac{9}{4}\) and the product equal to \(\frac{3}{4}\)?

1 \(4x^2 + 9x + 3 = 0\)
2 \(4x^2 + 9x - 3 = 0\)
3 \(4x^2 - 9x + 3 = 0\)
4 \(4x^2 - 9x - 3 = 0\)
75 What is the product of the roots of \( x^2 - 4x + k = 0 \) if one of the roots is 7?
1  21
2  -11
3  -21
4  -77

A2.A.7: FACTORING POLYNOMIALS

76 Factored completely, the expression \( 6x - x^3 - x^2 \) is equivalent to
1  \( x(x + 3)(x - 2) \)
2  \( x(x - 3)(x + 2) \)
3  \( -x(x - 3)(x + 2) \)
4  \( -x(x + 3)(x - 2) \)

77 Factored completely, the expression \( 12x^4 + 10x^3 - 12x^2 \) is equivalent to
1  \( x^2(4x + 6)(3x - 2) \)
2  \( 2(2x^2 + 3x)(3x^2 - 2x) \)
3  \( 2x^2(2x - 3)(3x + 2) \)
4  \( 2x^2(2x + 3)(3x - 2) \)

78 Factor completely: \( 10ax^2 - 23ax - 5a \)

A2.A.7: FACTORING THE DIFFERENCE OF PERFECT SQUARES

79 Factor the expression \( 12t^8 - 75t^4 \) completely.

A2.A.7: FACTORING BY GROUPING

80 When factored completely, \( x^3 + 3x^2 - 4x - 12 \) equals
1  \( (x + 2)(x - 2)(x - 3) \)
2  \( (x + 2)(x - 2)(x + 3) \)
3  \( (x^2 - 4)(x + 3) \)
4  \( (x^2 - 4)(x - 3) \)

81 When factored completely, the expression \( 3x^3 - 5x^2 - 48x + 80 \) is equivalent to
1  \( (x^2 - 16)(3x - 5) \)
2  \( (x^2 + 16)(3x - 5)(3x + 5) \)
3  \( (x + 4)(x - 4)(3x - 5) \)
4  \( (x + 4)(x - 4)(3x - 5)(3x + 5) \)

82 The expression \( x^2(x + 2) - (x + 2) \) is equivalent to
1  \( x^2 \)
2  \( x^2 - 1 \)
3  \( x^3 + 2x^2 - x + 2 \)
4  \( (x + 1)(x - 1)(x + 2) \)

A2.A.25: QUADRATIC FORMULA

83 The solutions of the equation \( y^2 - 3y = 9 \) are
1  \( \frac{3 \pm 3\sqrt{3}}{2} \)
2  \( \frac{3 \pm 3\sqrt{5}}{2} \)
3  \( \frac{-3 \pm 3\sqrt{5}}{2} \)
4  \( \frac{3 \pm 3\sqrt{5}}{2} \)

84 The roots of the equation \( 2x^2 + 7x - 3 = 0 \) are
1  \(-\frac{1}{2}\) and \(-3\)
2  \(\frac{1}{2}\) and \(3\)
3  \(-\frac{7 \pm \sqrt{73}}{4} \)
4  \(\frac{7 \pm \sqrt{73}}{4} \)

85 Solve the equation \( 6x^2 - 2x - 3 = 0 \) and express the answer in simplest radical form.

A2.A.2: USING THE DISCRIMINANT

86 Use the discriminant to determine all values of \( k \) that would result in the equation \( x^2 - kx + 4 = 0 \) having equal roots.
87 The roots of the equation $9x^2 + 3x - 4 = 0$ are
1. imaginary
2. real, rational, and equal
3. real, rational, and unequal
4. real, irrational, and unequal

88 The roots of the equation $x^2 - 10x + 25 = 0$ are
1. imaginary
2. real and irrational
3. real, rational, and equal
4. real, rational, and unequal

89 The discriminant of a quadratic equation is 24. The roots are
1. imaginary
2. real, rational, and equal
3. real, rational, and unequal
4. real, irrational, and unequal

90 The roots of the equation $2x^2 + 4 = 9x$ are
1. real, rational, and equal
2. real, rational, and unequal
3. real, irrational, and unequal
4. imaginary

A2.A.24: COMPLETING THE SQUARE

91 Solve $2x^2 - 12x + 4 = 0$ by completing the square, expressing the result in simplest radical form.

92 If $x^2 + 2 = 6x$ is solved by completing the square, an intermediate step would be
1. $(x + 3)^2 = 7$
2. $(x - 3)^2 = 7$
3. $(x - 3)^2 = 11$
4. $(x - 6)^2 = 34$

93 Brian correctly used a method of completing the square to solve the equation $x^2 + 7x - 11 = 0$. Brian’s first step was to rewrite the equation as $x^2 + 7x = 11$. He then added a number to both sides of the equation. Which number did he add?
1. $\frac{7}{2}$
2. $\frac{49}{4}$
3. $\frac{49}{2}$
4. 49

94 Max solves a quadratic equation by completing the square. He shows a correct step:

$$(x + 2)^2 = -9$$

What are the solutions to his equation?
1. $2 \pm 3i$
2. $-2 \pm 3i$
3. $3 \pm 2i$
4. $-3 \pm 2i$
95 Which graph best represents the inequality \( y + 6 \geq x^2 - x? \)

96 The solution set of the inequality \( x^2 - 3x > 10 \) is
1 \( \{x | -2 < x < 5\} \)
2 \( \{x | 0 < x < 3\} \)
3 \( \{x | x < -2 \text{ or } x > 5\} \)
4 \( \{x | x < -5 \text{ or } x > 2\} \)

97 Find the solution of the inequality \( x^2 - 4x > 5 \), algebraically.

**SYSTEMS**

98 Which values of \( x \) are in the solution set of the following system of equations?

\[
\begin{align*}
y &= 3x - 6 \\
y &= x^2 - x - 6
\end{align*}
\]

1 \( 0, -4 \)
2 \( 0, 4 \)
3 \( 6, -2 \)
4 \( -6, 2 \)

99 Solve the following systems of equations algebraically:

\[
\begin{align*}
5 &= y - x \\
4x^2 &= -17x + y + 4
\end{align*}
\]

100 Which ordered pair is a solution of the system of equations shown below?

\[
\begin{align*}
x + y &= 5 \\
(x + 3)^2 + (y - 3)^2 &= 53
\end{align*}
\]

1 \( (2, 3) \)
2 \( (5, 0) \)
3 \( (-5, 10) \)
4 \( (-4, 9) \)

101 Which ordered pair is in the solution set of the system of equations shown below?

\[
\begin{align*}
y^2 - x^2 + 32 &= 0 \\
3y - x &= 0
\end{align*}
\]

1 \( (2, 6) \)
2 \( (3, 1) \)
3 \( (-1, -3) \)
4 \( (-6, -2) \)
102 Determine algebraically the $x$-coordinate of all points where the graphs of $xy = 10$ and $y = x + 3$ intersect.

**POWERS**

A2.N.3: OPERATIONS WITH POLYNOMIALS

103 Express $\left(\frac{2}{3}x - 1\right)^2$ as a trinomial.

104 When $\frac{3}{2}x^2 - \frac{1}{4}x - 4$ is subtracted from $\frac{5}{2}x^2 - \frac{3}{4}x + 1$, the difference is
1. $-x^2 + \frac{1}{2}x - 5$
2. $x^2 - \frac{1}{2}x + 5$
3. $-x^2 - x - 3$
4. $x^2 - x - 3$

105 Express the product of $\left(\frac{1}{2}y^2 - \frac{1}{3}y\right)$ and $\left(12y + \frac{3}{5}\right)$ as a trinomial.

106 What is the product of $\left(\frac{x}{4} - \frac{1}{3}\right)$ and $\left(\frac{x}{4} + \frac{1}{3}\right)$?
1. $\frac{x^2}{8} - \frac{1}{9}$
2. $\frac{x^2}{16} - \frac{1}{9}$
3. $\frac{x^2}{8} - \frac{x}{6} - \frac{1}{9}$
4. $\frac{x^2}{16} - \frac{x}{6} - \frac{1}{9}$

107 What is the product of $\left(\frac{2}{5}x - \frac{3}{4}y^2\right)$ and $\left(\frac{2}{5}x + \frac{3}{4}y^2\right)$?
1. $\frac{4}{25}x^2 - \frac{9}{16}y^4$
2. $\frac{4}{25}x - \frac{9}{16}y^2$
3. $\frac{2}{5}x^2 - \frac{3}{4}y^4$
4. $\frac{4}{5}x$

108 When $x^2 + 3x - 4$ is subtracted from $x^3 + 3x^2 - 2x$, the difference is
1. $x^3 + 2x^2 - 5x + 4$
2. $x^3 + 2x^2 + x - 4$
3. $-x^3 + 4x^2 + x - 4$
4. $-x^3 - 2x^2 + 5x + 4$

A2.N.1, A.8-9: NEGATIVE AND FRACTIONAL EXPONENTS

109 If $a = 3$ and $b = -2$, what is the value of the expression $\frac{a^{-2}}{b^{-3}}$?
1. $\frac{-9}{8}$
2. $-1$
3. $\frac{-8}{9}$
4. $\frac{8}{9}$

110 If $n$ is a negative integer, then which statement is always true?
1. $6n^{-2} < 4n^{-1}$
2. $\frac{n}{4} > -6n^{-1}$
3. $6n^{-1} < 4n^{-1}$
4. $4n^{-1} > (6n)^{-1}$
111 When simplified, the expression \( \left( \frac{w^{-5}}{w^{-9}} \right)^{\frac{1}{2}} \) is equivalent to
1 \( w^{-7} \)
2 \( w^{2} \)
3 \( w^{7} \)
4 \( w^{14} \)

112 Which expression is equivalent to \( (9x^2y^6)^{-\frac{1}{2}} \)?
1 \( \frac{1}{3xy^3} \)
2 \( 3xy^3 \)
3 \( \frac{3}{xy^3} \)
4 \( \frac{xy^3}{3} \)

113 Which expression is equivalent to \( (3x^2)^{-1} \)?
1 \( \frac{1}{3x^2} \)
2 \( -3x^2 \)
3 \( \frac{1}{9x^2} \)
4 \( -9x^2 \)

114 The expression \( \frac{a^2b^{-3}}{a^{-4}b^2} \) is equivalent to
1 \( \frac{a^6}{b^5} \)
2 \( \frac{b^5}{a^6} \)
3 \( \frac{a^2}{b} \)
4 \( a^{-2}b^{-1} \)

115 When \( x^{-1} - 1 \) is divided by \( x - 1 \), the quotient is
1 \( -1 \)
2 \( \frac{1}{x} \)
3 \( \frac{1}{x^2} \)
4 \( \frac{1}{(x - 1)^2} \)

116 Simplify the expression \( \frac{3x^{-4}y^5}{(2x^3y^{-7})^{-2}} \) and write the answer using only positive exponents.

117 When \( x^{-1} + 1 \) is divided by \( x + 1 \), the quotient equals
1 \( 1 \)
2 \( \frac{1}{x} \)
3 \( x \)
4 \( -\frac{1}{x} \)

118 Which expression is equivalent to \( \frac{x^{-1}y^4}{3x^{-5}y^{-1}} \)?
1 \( \frac{x^4y^5}{3} \)
2 \( \frac{x^5y^4}{3} \)
3 \( 3x^4y^5 \)
4 \( \frac{y^4}{3x^5} \)
119 Which expression is equivalent to $\frac{2x^2y^2}{4y^5}$?

1. $\frac{y^3}{2x^2}$
2. $\frac{2y^3}{x^2}$
3. $\frac{2x^2}{y^3}$
4. $\frac{x^2}{2y^3}$

A2.A.12: EVALUATING EXPONENTIAL EXPRESSIONS

120 Matt places $1,200 in an investment account earning an annual rate of 6.5%, compounded continuously. Using the formula $V = Pe^{rt}$, where $V$ is the value of the account in $t$ years, $P$ is the principal initially invested, $e$ is the base of a natural logarithm, and $r$ is the rate of interest, determine the amount of money, to the nearest cent, that Matt will have in the account after 10 years.

121 Evaluate $e^{\ln y}$ when $x = 3$ and $y = 2$.

122 The formula for continuously compounded interest is $A = Pe^{rt}$, where $A$ is the amount of money in the account, $P$ is the initial investment, $r$ is the interest rate, and $t$ is the time in years. Using the formula, determine, to the nearest dollar, the amount in the account after 8 years if $750 is invested at an annual rate of 3%.

123 If $5000 is invested at a rate of 3% interest compounded quarterly, what is the value of the investment in 5 years? (Use the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where $A$ is the amount accrued, $P$ is the principal, $r$ is the interest rate, $n$ is the number of times per year the money is compounded, and $t$ is the length of time, in years.)

$\begin{array}{ll}
1 & \$5190.33 \\
2 & \$5796.37 \\
3 & \$5805.92 \\
4 & \$5808.08 \\
\end{array}$

A2.A.18: EVALUATING LOGARITHMIC EXPRESSIONS

124 The expression $\log_864$ is equivalent to

$\begin{array}{ll}
1 & 8 \\
2 & 2 \\
3 & \frac{1}{2} \\
4 & \frac{1}{8} \\
\end{array}$

125 The expression $\log_5\left(\frac{1}{25}\right)$ is equivalent to

$\begin{array}{ll}
1 & \frac{1}{2} \\
2 & 2 \\
3 & \frac{-1}{2} \\
4 & -2 \\
\end{array}$
A2.A.53: GRAPHING EXPONENTIAL FUNCTIONS

126 The graph of the equation \( y = \left( \frac{1}{2} \right)^x \) has an asymptote. On the grid below, sketch the graph of \( y = \left( \frac{1}{2} \right)^x \) and write the equation of this asymptote.

127 On the axes below, for \(-2 \leq x \leq 2\), graph \( y = 2^{x+1} - 3 \).

128 What is the equation of the graph shown below?

1. \( y = 2^x \)
2. \( y = 2^{-x} \)
3. \( x = 2^y \)
4. \( x = 2^{-y} \)
129 If a function is defined by the equation \( f(x) = 4^x \), which graph represents the inverse of this function?

130 Which graph represents the function \( \log_2 x = y \)?
131 Which sketch shows the inverse of \( y = a^x \), where \( a > 1 \)?

132 The expression \( 2 \log x - (3 \log y + \log z) \) is equivalent to

1 \( \log \frac{x^2}{y^3z} \)
2 \( \log \frac{x^2z}{y^3} \)
3 \( \log \frac{2x}{3yz} \)
4 \( \log \frac{2xyz}{3y} \)

133 If \( r = \frac{\sqrt[3]{A^2B}}{C} \), then \( \log r \) can be represented by

1 \( \frac{1}{6} \log A + \frac{1}{3} \log B - \log C \)
2 \( 3(\log A^2 + \log B - \log C) \)
3 \( \frac{1}{3} \log(A^2 + B) - C \)
4 \( \frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C \)

134 If \( \log x^2 - \log 2a = \log 3a \), then \( \log x \) expressed in terms of \( \log a \) is equivalent to

1 \( \frac{1}{2} \log 5a \)
2 \( \frac{1}{2} \log 6 + \log a \)
3 \( \log 6 + \log a \)
4 \( \log 6 + 2 \log a \)

135 If \( \log_{e^p} x = 3 \log_{e^t} p - \left( 2 \log_{e^t} t + \frac{1}{2} \log_{e^r} r \right) \), then the value of \( x \) is

1 \( \frac{p^3}{\sqrt{t^2r}} \)
2 \( p^3 \sqrt{t^2r} \)
3 \( \frac{p^3 \sqrt{t^2}}{r} \)
4 \( \frac{p^3}{t^2 \sqrt{r}} \)

136 If \( \log 2 = a \) and \( \log 3 = b \), the expression \( \log \frac{9}{20} \) is equivalent to

1 \( 2b - a + 1 \)
2 \( 2b - a - 1 \)
3 \( b^2 - a + 10 \)
4 \( \frac{2b}{a + 1} \)
137 The expression \( \log_4 m^2 \) is equivalent to
1. \( 2(\log_4 + \log m) \)
2. \( 2\log_4 + \log m \)
3. \( \log_4 + 2\log m \)
4. \( \log 16 + 2\log m \)

A2.A.28: LOGARITHMIC EQUATIONS

138 What is the solution of the equation \( 2 \log_4(5x) = 3? \)
1. 6.4
2. 2.56
3. \( \frac{9}{5} \)
4. \( \frac{8}{5} \)

139 Solve algebraically for \( x \): \( \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \)

140 The temperature, \( T \), of a given cup of hot chocolate after it has been cooling for \( t \) minutes can best be modeled by the function below, where \( T_0 \) is the temperature of the room and \( k \) is a constant.
\[
\ln(T - T_0) = -kt + 4.718
\]
A cup of hot chocolate is placed in a room that has a temperature of 68°. After 3 minutes, the temperature of the hot chocolate is 150°. Compute the value of \( k \) to the nearest thousandth. [Only an algebraic solution can receive full credit.] Using this value of \( k \), find the temperature, \( T \), of this cup of hot chocolate if it has been sitting in this room for a total of 10 minutes. Express your answer to the nearest degree. [Only an algebraic solution can receive full credit.]

A2.A.6, 27: EXPONENTIAL EQUATIONS

143 Solve algebraically for all values of \( x \):
\[
\log_{2x+4}(17x - 4) = 2
\]

144 Solve algebraically for \( x \):
\[
\log_{2x}(2x - 1) = \frac{4}{3}
\]

145 Solve algebraically for all values of \( x \):
\[
\log_{(x+3)}(2x + 3) + \log_{(x+3)}(x + 5) = 2
\]

146 Akeem invests $25,000 in an account that pays 4.75% annual interest compounded continuously. Using the formula \( A = Pe^{rt} \), where \( A \) is the amount in the account after \( t \) years, \( P \) is the principal invested, and \( r \) is the annual interest rate, how many years, to the nearest tenth, will it take for Akeem’s investment to triple?
1. 10.0
2. 14.6
3. 23.1
4. 24.0

147 A population of rabbits doubles every 60 days according to the formula \( P = 10(2)^{t/60} \), where \( P \) is the population of rabbits on day \( t \). What is the value of \( t \) when the population is 320?
1. 240
2. 300
3. 660
4. 960

148 The number of bacteria present in a Petri dish can be modeled by the function \( N = 50e^{3t} \), where \( N \) is the number of bacteria present in the Petri dish after \( t \) hours. Using this model, determine, to the nearest hundredth, the number of hours it will take for \( N \) to reach 30,700.
149 Susie invests $500 in an account that is compounded continuously at an annual interest rate of 5%, according to the formula $A = Pe^{rt}$, where $A$ is the amount accrued, $P$ is the principal, $r$ is the rate of interest, and $t$ is the time, in years. Approximately how many years will it take for Susie’s money to double?

1. 1.4
2. 6.0
3. 13.9
4. 14.7

150 The solution set of $4x^2 + 4x = 2^{-6}$ is

1. $\{1, 3\}$
2. $\{-1, 3\}$
3. $\{-1, -3\}$
4. $\{1, -3\}$

151 What is the value of $x$ in the equation $9^{3x + 1} = 27^{x + 2}$?

1. 1
2. $\frac{1}{3}$
3. $\frac{1}{2}$
4. $\frac{4}{3}$

152 Solve algebraically for $x$: $16^2x^3 = 64x + 2$

153 The value of $x$ in the equation $4^{2x + 5} = 8^{3x}$ is

1. 1
2. 2
3. 5
4. -10

154 Solve algebraically for all values of $x$:

$81x^7 + 2x^2 = 27x\frac{5x}{3}$

155 Which value of $k$ satisfies the equation $8^{3k + 4} = 4^{2k - 1}$?

1. -1
2. $\frac{9}{4}$
3. -2
4. $-\frac{14}{5}$

A2.A.36: BINOMIAL EXPANSIONS

156 What is the fourth term in the expansion of $(3x - 2)^3$?

1. $-720x^2$
2. $-240x$
3. $720x^2$
4. $1,080x^3$

157 Write the binomial expansion of $(2x - 1)^5$ as a polynomial in simplest form.

158 What is the coefficient of the fourth term in the expansion of $(a - 4b)^9$?

1. $-5,376$
2. $-336$
3. $336$
4. $5,376$

159 Which expression represents the third term in the expansion of $(2x^4 - y)^3$?

1. $-y^3$
2. $-6x^4y^2$
3. $6x^4y^2$
4. $2x^4y^2$

160 What is the middle term in the expansion of $\left(\frac{x}{2} - 2y\right)^6$?

1. $20x^3y^3$
2. $-\frac{15}{4}x^4y^2$
3. $-20x^3y^3$
4. $\frac{15}{4}x^4y^2$
161 What is the fourth term in the binomial expansion \((x - 2)^8\)?

1  448x^5
2  448x^4
3  -448x^5
4  -448x^4

A2.A.26, 50: SOLVING POLYNOMIAL EQUATIONS

162 Solve the equation \(8x^3 + 4x^2 - 18x - 9 = 0\) algebraically for all values of \(x\).

163 Which values of \(x\) are solutions of the equation \(x^3 + x^2 - 2x = 0\)?

1  0, 1, 2
2  0, 1, -2
3  0, -1, 2
4  0, -1, -2

164 What is the solution set of the equation \(3x^5 - 48x = 0\)?

1  \(\{0, \pm 2\}\)
2  \(\{0, \pm 2, 3\}\)
3  \(\{0, \pm 2, \pm 2i\}\)
4  \(\{\pm 2, \pm 2i\}\)

165 Solve algebraically for all values of \(x\):
\[x^4 + 4x^3 + 4x^2 = -16x\]

166 The graph of \(y = f(x)\) is shown below.

Which set lists all the real solutions of \(f(x) = 0\)?

1  \(\{-3, 2\}\)
2  \(\{-2, 3\}\)
3  \(\{-3, 0, 2\}\)
4  \(\{-2, 0, 3\}\)
167 The graph of \( y = x^3 - 4x^2 + x + 6 \) is shown below.

What is the product of the roots of the equation \( x^3 - 4x^2 + x + 6 = 0 \)?

1. 1
2. 2
3. 3
4. 4

168 How many negative solutions to the equation \( 2x^3 - 4x^2 + 3x - 1 = 0 \) exist?

1. 1
2. 2
3. 3
4. 0

RADICALS

A2.N.4: OPERATIONS WITH IRRATIONAL EXPRESSIONS

169 The product of \( (3 + \sqrt{5}) \) and \( (3 - \sqrt{5}) \) is

1. \( 4 - 6\sqrt{5} \)
2. \( 14 - 6\sqrt{5} \)
3. 14
4. 4

A2.A.13: SIMPLIFYING RADICALS

170 Express in simplest form: \( \frac{\sqrt[3]{a^6b^9}}{64} \)

171 The expression \( \sqrt[3]{64a^{16}} \) is equivalent to

1. \( 8a^4 \)
2. \( 8a^8 \)
3. \( 4a^3\sqrt{a} \)
4. \( 4a^3\sqrt{a^5} \)

A2.N.2, A.14: OPERATIONS WITH RADICALS

172 Express \( 5\sqrt{3x^3} - 2\sqrt{27x^3} \) in simplest radical form.

173 The sum of \( \sqrt[3]{6a^4b^2} \) and \( \sqrt[3]{162a^4b^2} \), expressed in simplest radical form, is

1. \( \sqrt[3]{168a^8b^4} \)
2. \( 2a^2b\sqrt[3]{21a^2b} \)
3. \( 4a^3\sqrt{6ab^2} \)
4. \( 10a^2b\sqrt[3]{8} \)

174 The expression \( \left( \sqrt[3]{27x^2} \right) \left( \sqrt[3]{16x^4} \right) \) is equivalent to

1. \( 12x^{2\frac{3}{2}} \)
2. \( 12x^{\frac{3}{2}}x \)
3. \( 6x^{3\frac{3}{2}x^2} \)
4. \( 6x^{\frac{3}{2}} \)

175 The expression \( 4ab\sqrt{2b} - 3a\sqrt{18b^3} + 7ab\sqrt{6b} \) is equivalent to

1. \( 2ab\sqrt{6b} \)
2. \( 16ab\sqrt{2b} \)
3. \( -5ab + 7ab\sqrt{6b} \)
4. \( -5ab\sqrt{2b} + 7ab\sqrt{6b} \)
176 Express \( \frac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}} \) in simplest radical form.

A2.N.5, A.15: RATIONALIZING DENOMINATORS

177 Express \( \frac{5}{3 - \sqrt{2}} \) with a rational denominator, in simplest radical form.

178 Which expression is equivalent to \( \frac{\sqrt{3} + 5}{\sqrt{3} - 5} \)?

1. \( \frac{14 + 5\sqrt{3}}{11} \)
2. \( \frac{17 + 5\sqrt{3}}{11} \)
3. \( \frac{14 + 5\sqrt{3}}{14} \)
4. \( \frac{17 + 5\sqrt{3}}{14} \)

179 The expression \( \frac{4}{5 - \sqrt{13}} \) is equivalent to

1. \( \frac{4\sqrt{13}}{5\sqrt{13} - 13} \)
2. \( \frac{4(5 - \sqrt{13})}{38} \)
3. \( \frac{5 + \sqrt{13}}{3} \)
4. \( \frac{4(5 + \sqrt{13})}{38} \)

180 The expression \( \frac{1}{7 - \sqrt{11}} \) is equivalent to

1. \( \frac{7 + \sqrt{11}}{38} \)
2. \( \frac{7 - \sqrt{11}}{38} \)
3. \( \frac{7 + \sqrt{11}}{60} \)
4. \( \frac{7 - \sqrt{11}}{60} \)

181 The fraction \( \frac{3}{\sqrt{3a^2b}} \) is equivalent to

1. \( \frac{1}{a\sqrt{b}} \)
2. \( \frac{\sqrt{b}}{ab} \)
3. \( \frac{\sqrt{3b}}{ab} \)
4. \( \frac{\sqrt{3}}{a} \)

182 The expression \( \frac{2x + 4}{\sqrt{x} + 2} \) is equivalent to

1. \( \frac{(2x + 4)\sqrt{x} - 2}{x - 2} \)
2. \( \frac{(2x + 4)\sqrt{x} - 2}{x - 4} \)
3. \( 2\sqrt{x} - 2 \)
4. \( 2\sqrt{x} + 2 \)

183 Expressed with a rational denominator and in simplest form, \( \frac{x}{x - \sqrt{x}} \) is

1. \( \frac{x^2 + x\sqrt{x}}{x^2 - x} \)
2. \( -\sqrt{x} \)
3. \( \frac{x + \sqrt{x}}{1 - x} \)
4. \( \frac{x + \sqrt{x}}{x - 1} \)
A2.A.22: SOLVING RADICALS

184 The solution set of the equation \( \sqrt{x + 3} = 3 - x \) is
1 \( \{1\} \)
2 \( \{0\} \)
3 \( \{1, 6\} \)
4 \( \{2, 3\} \)

185 The solution set of \( \sqrt{3x + 16} = x + 2 \) is
1 \( \{-3, 4\} \)
2 \( \{-4, 3\} \)
3 \( \{3\} \)
4 \( \{-4\} \)

186 Solve algebraically for \( x \): \( 4 - \sqrt{2x - 5} = 1 \)

187 What is the solution set for the equation \( \sqrt{5x + 29} = x + 3 \)?
1 \( \{4\} \)
2 \( \{-5\} \)
3 \( \{4, 5\} \)
4 \( \{-5, 4\} \)

188 Solve algebraically for \( x \):
\( \sqrt{x^2 + x - 1 + 11x} = 7x + 3 \)

A2.A.10-11: EXPONENTS AS RADICALS

189 The expression \( (x^2 - 1)^{-\frac{2}{3}} \) is equivalent to
1 \( \sqrt[3]{(x^2 - 1)^2} \)
2 \( \frac{1}{\sqrt[3]{(x^2 - 1)^2}} \)
3 \( \sqrt{(x^2 - 1)^2} \)
4 \( \frac{1}{\sqrt{(x^2 - 1)^3}} \)

190 The expression \( \frac{x}{5} \) is equivalent to
1 \( \frac{1}{5} \sqrt{x^5} \)
2 \( \frac{1}{5} \sqrt{x^2} \)
3 \( \frac{1}{\sqrt[3]{x^5}} \)
4 \( \frac{1}{\sqrt[3]{x^2}} \)

191 The expression \( \sqrt[4]{16x^2y^7} \) is equivalent to
1 \( 2x \sqrt[4]{x^2y^7} \)
2 \( 2x^8y^{28} \)
3 \( 4x \sqrt[4]{y^7} \)
4 \( 4x^8y^{28} \)

A2.N.6: SQUARE ROOTS OF NEGATIVE NUMBERS

192 In simplest form, \( \sqrt{-300} \) is equivalent to
1 \( 3i \sqrt{10} \)
2 \( 5i \sqrt{12} \)
3 \( 10i \sqrt{3} \)
4 \( 12i \sqrt{5} \)

A2.N.7: IMAGINARY NUMBERS

193 The product of \( i^7 \) and \( i^5 \) is equivalent to
1 \( 1 \)
2 \( -1 \)
3 \( i \)
4 \( -i \)

194 The expression \( 2i^2 + 3i^3 \) is equivalent to
1 \( -2 - 3i \)
2 \( 2 - 3i \)
3 \( -2 + 3i \)
4 \( 2 + 3i \)

195 Determine the value of \( n \) in simplest form:
\( i^{13} + i^{18} + i^{31} + n = 0 \)
196 Express $4xi + 5yi^8 + 6xi^3 + 2yi^4$ in simplest $a + bi$ form.

A2.N.8: CONJUGATES OF COMPLEX NUMBERS

197 What is the conjugate of $-2 + 3i$?
1 $-3 + 2i$
2 $-2 - 3i$
3 $2 - 3i$
4 $3 + 2i$

198 The conjugate of $7 - 5i$ is
1 $-7 - 5i$
2 $-7 + 5i$
3 $7 - 5i$
4 $7 + 5i$

199 What is the conjugate of $\frac{1}{2} + \frac{3}{2}i$?
1 $\frac{1}{2} + \frac{3}{2}i$
2 $\frac{1}{2} - \frac{3}{2}i$
3 $\frac{3}{2} + \frac{1}{2}i$
4 $\frac{1}{2} - \frac{3}{2}i$

200 The conjugate of the complex expression $-5x + 4i$ is
1 $5x - 4i$
2 $5x + 4i$
3 $-5x - 4i$
4 $-5x + 4i$

A2.N.9: MULTIPLICATION AND DIVISION OF COMPLEX NUMBERS

201 The expression $(3 - 7i)^2$ is equivalent to
1 $-40 + 0i$
2 $-40 - 42i$
3 $58 + 0i$
4 $58 - 42i$

202 The expression $(x + i)^2 - (x - i)^2$ is equivalent to
1 $0$
2 $-2$
3 $-2 + 4xi$
4 $4xi$

203 If $x = 3i$, $y = 2i$, and $z = m + i$, the expression $xy^2z$ equals
1 $-12 - 12mi$
2 $-6 - 6mi$
3 $12 - 12mi$
4 $6 - 6mi$

RATIONALS
A2.A.16: MULTIPLICATION AND DIVISION OF RATIONALS

204 Perform the indicated operations and simplify completely:
$$\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}$$

$$\frac{4 - x^2}{x^2 + 7x + 12} \div \frac{2x - 4}{x + 3}$$

205 Express in simplest form:
$$\frac{x^2 + 7x + 12}{2x - 4}$$

206 The expression $\frac{x^2 + 9x - 22}{x^2 - 121}$ is equivalent to
1 $x - 11$
2 $\frac{1}{x - 11}$
3 $11 - x$
4 $\frac{1}{11 - x}$
207 Expressed in simplest form, \( \frac{3y}{2y - 6} + \frac{9}{6 - 2y} \) is equivalent to
1 \( \frac{-6y^2 + 36y - 54}{(2y - 6)(6 - 2y)} \)
2 \( \frac{3y - 9}{2y - 6} \)
3 \( \frac{3}{2} \)
4 \( -\frac{3}{2} \)

208 Solve for \( x \): \( \frac{4x}{x - 3} = 2 + \frac{12}{x - 3} \)

209 Solve algebraically for \( x \): \( \frac{1}{x + 3} - \frac{2}{3 - x} = \frac{4}{x^2 - 9} \)

210 Solve the equation below algebraically, and express the result in simplest radical form:
\( \frac{13}{x} = 10 - x \)

211 Which graph represents the solution set of
\( \frac{x + 16}{x - 2} \leq 7? \)

212 Written in simplest form, the expression \( \frac{x}{2} - \frac{1}{x} \) is equivalent to
1 \( x - 1 \)
2 \( x - 2 \)
3 \( \frac{x - 2}{2} \)
4 \( \frac{x^2 - 4}{x + 2} \)

213 Express in simplest form:
\( \frac{1}{2} - \frac{4}{d} \)

214 The simplest form of \( \frac{1 - \frac{4}{x}}{1 - \frac{2}{x} - \frac{8}{x^2}} \) is
1 \( \frac{1}{2} \)
2 \( \frac{x}{x + 2} \)
3 \( \frac{x}{3} \)
4 \( -\frac{x}{x - 2} \)

215 The expression \( \frac{a + \frac{b}{c}}{d - \frac{b}{e}} \) is equivalent to
1 \( \frac{c + 1}{d - 1} \)
2 \( \frac{a + b}{d - b} \)
3 \( \frac{ac + b}{cd - b} \)
4 \( \frac{ac + 1}{cd - 1} \)
A2.A.5: INVERSE VARIATION

216 For a given set of rectangles, the length is inversely proportional to the width. In one of these rectangles, the length is 12 and the width is 6. For this set of rectangles, calculate the width of a rectangle whose length is 9.

217 If \( p \) varies inversely as \( q \), and \( p = 10 \) when \( q = \frac{3}{2} \), what is the value of \( p \) when \( q = \frac{3}{5} \)?

1. 25
2. 15
3. 9
4. 4

218 The quantities \( p \) and \( q \) vary inversely. If \( p = 20 \) when \( q = -2 \), and \( p = x \) when \( q = -2x + 2 \), then \( x \) equals

1. -4 and 5
2. \( \frac{20}{19} \)
3. -5 and 4
4. -\( \frac{1}{4} \)

219 The points \((2,3), (4, \frac{3}{4})\), and \((6,d)\) lie on the graph of a function. If \( y \) is inversely proportional to the square of \( x \), what is the value of \( d \)?

1. 1
2. \( \frac{1}{3} \)
3. 3
4. 27

220 If \( d \) varies inversely as \( t \), and \( d = 20 \) when \( t = 2 \), what is the value of \( t \) when \( d = -5 \)?

1. 8
2. 2
3. -8
4. -2

FUNCTIONS

A2.A.40-41: FUNCTIONAL NOTATION

221 The equation \( y - 2 \sin \theta = 3 \) may be rewritten as

1. \( f(y) = 2 \sin x + 3 \)
2. \( f(y) = 2 \sin \theta + 3 \)
3. \( f(x) = 2 \sin \theta + 3 \)
4. \( f(\theta) = 2 \sin \theta + 3 \)

222 If \( f(x) = \frac{x}{x^2 - 16} \), what is the value of \( f(-10) \)?

1. -\( \frac{5}{2} \)
2. \( \frac{5}{42} \)
3. \( \frac{5}{58} \)
4. \( \frac{5}{18} \)

223 If \( g(x) = \left(ax \sqrt{1-x}\right)^2 \), express \( g(10) \) in simplest form.
224 On January 1, a share of a certain stock cost $180. Each month thereafter, the cost of a share of this stock decreased by one-third. If \( x \) represents the time, in months, and \( y \) represents the cost of the stock, in dollars, which graph best represents the cost of a share over the following 5 months?

A2.A.52: FAMILIES OF FUNCTIONS

A2.A.52: PROPERTIES OF GRAPHS OF FUNCTIONS AND RELATIONS

225 Which statement about the graph of the equation \( y = e^x \) is not true?
1. It is asymptotic to the \( x \)-axis.
2. The domain is the set of all real numbers.
3. It lies in Quadrants I and II.
4. It passes through the point \((e, 1)\).

A2.A.52: IDENTIFYING THE EQUATION OF A GRAPH

226 Four points on the graph of the function \( f(x) \) are shown below.
\{\( (0, 1), (1, 2), (2, 4), (3, 8) \}\}
Which equation represents \( f(x) \)?
1. \( f(x) = 2^x \)
2. \( f(x) = 2x \)
3. \( f(x) = x + 1 \)
4. \( f(x) = \log_2 x \)

227 Which equation is represented by the graph below?

1. \( y = 5^x \)
2. \( y = 0.5^x \)
3. \( y = 5^{-x} \)
4. \( y = 0.5^{-x} \)
A2.A.38, 43: DEFINING FUNCTIONS

228 Which graph does not represent a function?

229 Which relation is not a function?
1 \((x - 2)^2 + y^2 = 4\)
2 \(x^2 + 4x + y = 4\)
3 \(x + y = 4\)
4 \(xy = 4\)

230 Which graph does not represent a function?
231 Which graph represents a relation that is not a function?

232 Given the relation \{ (8, 2), (3, 6), (7, 5), (k, 4) \}, which value of k will result in the relation not being a function?

233 Which function is not one-to-one?

234 Which graph represents a one-to-one function?

235 Which function is one-to-one?
236 Which function is one-to-one?
1. \( k(x) = x^2 + 2 \)
2. \( g(x) = x^3 + 2 \)
3. \( f(x) = |x| + 2 \)
4. \( j(x) = x^4 + 2 \)

237 Which diagram represents a relation that is both one-to-one and onto?

238 Which relation is both one-to-one and onto?

A2.A.39, 51: DOMAIN AND RANGE

239 What is the domain of the function \( f(x) = \sqrt{x - 2} + 3 \)?
1. \((-\infty, \infty)\)
2. \((2, \infty)\)
3. \([2, \infty)\)
4. \([3, \infty)\)

240 What is the range of \( f(x) = (x + 4)^2 + 7 \)?
1. \( y \geq -4 \)
2. \( y \geq 4 \)
3. \( y = 7 \)
4. \( y \geq 7 \)

241 What is the range of \( f(x) = |x - 3| + 2 \)?
1. \( \{x|x \geq 3\} \)
2. \( \{y|y \geq 2\} \)
3. \( \{x|x \in \text{real numbers}\} \)
4. \( \{y|y \in \text{real numbers}\} \)
242 If \( f(x) = \sqrt{9 - x^2} \), what are its domain and range?
1. domain: \( \{x \mid -3 \leq x \leq 3\} \); range: \( \{y \mid 0 \leq y \leq 3\} \)
2. domain: \( \{x \mid x \neq \pm 3\} \); range: \( \{y \mid 0 \leq y \leq 3\} \)
3. domain: \( \{x \mid x \leq -3 \text{ or } x \geq 3\} \); range: \( \{y \mid y \neq 0\} \)
4. domain: \( \{x \mid x \neq 3\} \); range: \( \{y \mid y \geq 0\} \)

243 For \( y = \frac{3}{\sqrt{x-4}} \), what are the domain and range?
1. \( \{x \mid x > 4\} \) and \( \{y \mid y > 0\} \)
2. \( \{x \mid x \geq 4\} \) and \( \{y \mid y > 0\} \)
3. \( \{x \mid x > 4\} \) and \( \{y \mid y \geq 0\} \)
4. \( \{x \mid x \geq 4\} \) and \( \{y \mid y \geq 0\} \)

244 What are the domain and the range of the function shown in the graph below?

1. \( \{x \mid x > -4\} \); \( \{y \mid y > 2\} \)
2. \( \{x \mid x \geq -4\} \); \( \{y \mid y \geq 2\} \)
3. \( \{x \mid x > 2\} \); \( \{y \mid y > -4\} \)
4. \( \{x \mid x \geq 2\} \); \( \{y \mid y \geq -4\} \)

245 The graph below represents the function \( y = f(x) \).

246 What is the domain of the function shown below?

1. \( -1 \leq x \leq 6 \)
2. \( -1 \leq y \leq 6 \)
3. \( -2 \leq x \leq 5 \)
4. \( -2 \leq y \leq 5 \)
247 What is the range of the function shown below?

\[\begin{array}{c}
1 & x \leq 0 \\
2 & x \geq 0 \\
3 & y \leq 0 \\
4 & y \geq 0 \\
\end{array}\]

**A2.A.42: COMPOSITIONS OF FUNCTIONS**

248 If \( f(x) = \frac{1}{2} x - 3 \) and \( g(x) = 2x + 5 \), what is the value of \((g \circ f)(4)\)?

\[\begin{array}{c}
1 & -13 \\
2 & 3.5 \\
3 & 3 \\
4 & 6 \\
\end{array}\]

249 If \( f(x) = x^2 - 5 \) and \( g(x) = 6x \), then \( g(f(x)) \) is equal to

\[\begin{array}{c}
1 & 6x^3 - 30x \\
2 & 6x^2 - 30 \\
3 & 36x^2 - 5 \\
4 & x^2 + 6x - 5 \\
\end{array}\]

250 If \( f(x) = x^2 - 6 \) and \( g(x) = 2^x - 1 \), determine the value of \((g \circ f)(-3)\).

251 If \( f(x) = 4x - x^2 \) and \( g(x) = \frac{1}{x} \), then \((f \circ g)\left(\frac{1}{2}\right)\) is equal to

\[\begin{array}{c}
1 & \frac{4}{7} \\
2 & -2 \\
3 & \frac{7}{2} \\
4 & 4 \\
\end{array}\]

252 Which expression is equivalent to \((n \circ m \circ p)(x)\), given \( m(x) = \sin x \), \( n(x) = 3x \), and \( p(x) = x^2\)?

\[\begin{array}{c}
1 & \sin(3x)^2 \\
2 & 3 \sin x^2 \\
3 & \sin^2(3x) \\
4 & 3 \sin^2 x \\
\end{array}\]

253 If \( g(x) = \frac{1}{2} x + 8 \) and \( h(x) = \frac{1}{2} x - 2 \), what is the value of \( g(h(-8))\)?

\[\begin{array}{c}
1 & 0 \\
2 & 9 \\
3 & 5 \\
4 & 4 \\
\end{array}\]

**A2.A.44: INVERSE OF FUNCTIONS**

254 Which two functions are inverse functions of each other?

\[\begin{array}{c}
1 & f(x) = \sin x \text{ and } g(x) = \cos x \\
2 & f(x) = 3 + 8x \text{ and } g(x) = 3 - 8x \\
3 & f(x) = e^x \text{ and } g(x) = \ln x \\
4 & f(x) = 2x - 4 \text{ and } g(x) = -\frac{1}{2} x + 4 \\
\end{array}\]

255 If \( f(x) = x^2 - 6 \), find \( f^{-1}(x) \).
A2.A.46: TRANSFORMATIONS WITH FUNCTIONS AND RELATIONS

256 The graph below shows the function \( f(x) \).

Which graph represents the function \( f(x + 2) \)?

257 The minimum point on the graph of the equation \( y = f(x) \) is \((-1,-3)\). What is the minimum point on the graph of the equation \( y = f(x) + 5 \)?
1 \((-1,2)\)
2 \((-1,-8)\)
3 \((4,-3)\)
4 \((-6,-3)\)

SEQUENCES AND SERIES
A2.A.29-33: SEQUENCES

258 What is the formula for the \( n \)th term of the sequence 54, 18, 6, . . .?

1 \( a_n = 6 \left( \frac{1}{3} \right)^n \)
2 \( a_n = 6 \left( \frac{1}{3} \right)^{n-1} \)
3 \( a_n = 54 \left( \frac{1}{3} \right)^n \)
4 \( a_n = 54 \left( \frac{1}{3} \right)^{n-1} \)

259 What is a formula for the \( n \)th term of sequence \( B \) shown below?
\( B = 10, 12, 14, 16, \ldots \)

1 \( b_n = 8 + 2n \)
2 \( b_n = 10 + 2n \)
3 \( b_n = 10(2)^n \)
4 \( b_n = 10(2)^{n-1} \)

260 A sequence has the following terms: \( a_1 = 4, a_2 = 10, a_3 = 25, a_4 = 62.5 \). Which formula represents the \( n \)th term in the sequence?
1 \( a_n = 4 + 2.5n \)
2 \( a_n = 4 + 2.5(n-1) \)
3 \( a_n = 4(2.5)^n \)
4 \( a_n = 4(2.5)^{n-1} \)

261 In an arithmetic sequence, \( a_4 = 19 \) and \( a_7 = 31 \). Determine a formula for \( a_n \), the \( n \)th term of this sequence.
262 What is the common difference of the arithmetic sequence 5, 8, 11, 14?

1 8
2 3
3 9

263 Which arithmetic sequence has a common difference of 4?

1 {0, 4n, 8n, 12n, . . . }
2 {n, 4n, 16n, 64n, . . . }
3 {n + 1, n + 5, n + 9, n + 13, . . . }
4 {n + 4, n + 16, n + 64, n + 256, . . . }

264 What is the common difference in the sequence 2a + 1, 4a + 4, 6a + 7, 8a + 10, . . . ?

1 2a + 3
2 −2a − 3
3 2a + 5
4 −2a + 5

265 What is the common ratio of the geometric sequence whose first term is 27 and fourth term is 64?

1 3
2 64
3 4
4 37

266 What is the common ratio of the geometric sequence shown below?

−2, 4, −8, 16, . . .

1 −1
2 2
3 −2
4 −6

267 What is the common ratio of the sequence

\[
\frac{1}{64} a^5 b^3, -\frac{3}{32} a^3 b^4, \frac{9}{16} a b^5, \ldots
\]

1 \frac{3b}{2a^2}
2 \frac{6b}{a^2}
3 \frac{3a^2}{b}
4 \frac{6a^2}{b}

268 What is the fifteenth term of the sequence 5, −10, 20, −40, 80, . . . ?

1 −163, 840
2 −81, 920
3 81, 920
4 327, 680

269 What is the fifteenth term of the geometric sequence \(−\sqrt{5}, \sqrt{10}, −2\sqrt{5}, . . . \) ?

1 −128 \sqrt{5}
2 128 \sqrt{10}
3 −16384 \sqrt{5}
4 16384 \sqrt{10}

270 Find the first four terms of the recursive sequence defined below.

\[ a_1 = -3 \]
\[ a_n = a_{(n - 1)} - n \]

271 Find the third term in the recursive sequence

\[ a_{k + 1} = 2a_k - 1, \text{ where } a_1 = 3. \]

A2.N.10, A.34: SIGMA NOTATION

272 The value of the expression

\[ 2 \sum_{n=0}^{2} (n^2 + 2^n) \]

1 12
2 22
3 24
4 26
273 Evaluate: $10 + \sum_{n=1}^{5}(n^3 - 1)$

274 The value of the expression $\sum_{r=3}^{5}(-r^2 + r)$ is

1  $-38$
2  $-12$
3  26
4  62

275 Evaluate: $\sum_{n=1}^{3}(-n^4 - n)$

276 The expression $4 + \sum_{k=2}^{5}3(k - x)$ is equal to

1  $58 - 4x$
2  $46 - 4x$
3  $58 - 12x$
4  $46 - 12x$

277 Which expression is equivalent to $\sum_{n=1}^{4}(a - n)^2$?

1  $2a^2 + 17$
2  $4a^2 + 30$
3  $2a^2 - 10a + 17$
4  $4a^2 - 20a + 30$

278 Mrs. Hill asked her students to express the sum $1 + 3 + 5 + 7 + 9 + \ldots + 39$ using sigma notation. Four different student answers were given. Which student answer is correct?

1  $\sum_{k=1}^{20}(2k - 1)$
2  $\sum_{k=2}^{40}(k - 1)$
3  $\sum_{k=-1}^{37}(k + 2)$
4  $\sum_{k=1}^{39}(2k - 1)$

279 Express the sum $7 + 14 + 21 + 28 + \ldots + 105$ using sigma notation.

280 Which summation represents $5 + 7 + 9 + 11 + \ldots + 43$?

1  $\sum_{n=5}^{43}n$
2  $\sum_{n=1}^{20}(2n + 3)$
3  $\sum_{n=4}^{24}(2n - 3)$
4  $\sum_{n=3}^{23}(3n - 4)$

A2.A.35: SERIES

281 An auditorium has 21 rows of seats. The first row has 18 seats, and each succeeding row has two more seats than the previous row. How many seats are in the auditorium?

1  540
2  567
3  760
4  798
282 What is the sum of the first 19 terms of the sequence 3, 10, 17, 24, 31,…?
1 1188
2 1197
3 1254
4 1292

283 Determine the sum of the first twenty terms of the sequence whose first five terms are 5, 14, 23, 32, 41.

284 The sum of the first eight terms of the series
3 – 12 + 48 – 192 + … is
1 –13,107
2 –21,845
3 –39,321
4 –65,535

TRIGONOMETRY
A2.A.55: TRIGONOMETRIC RATIOS

285 In the diagram below of right triangle $KTW$, $KW = 6$, $KT = 5$, and $m\angle KTW = 90$. What is the measure of $\angle K$, to the nearest minute?

What is the value of cot$J$?
1 $\frac{\sqrt{3}}{3}$
2 2
3 $\frac{\sqrt{3}}{3}$
4 $2\frac{\sqrt{3}}{3}$

286 Which ratio represents $\csc A$ in the diagram below?

1 $\frac{25}{24}$
2 $\frac{25}{7}$
3 $\frac{24}{7}$
4 $\frac{7}{24}$

287 In the diagram below of right triangle $JTM$, $JT = 12$, $JM = 6$, and $m\angle JMT = 90$. What is the value of cot$J$?

1 $\frac{\sqrt{3}}{3}$
2 2
3 $\frac{\sqrt{3}}{3}$
4 $2\frac{\sqrt{3}}{3}$
288 In the diagram below, the length of which line segment is equal to the exact value of \( \sin \theta \)?

\[
\begin{array}{c}
(0,0) & T \\
(-1,0) & O \\
(1,0) & S \\
(0,-1) & R \\
\end{array}
\]

1. \( TO \)  
2. \( TS \)  
3. \( OR \)  
4. \( OS \)

289 In the right triangle shown below, what is the measure of angle \( S \), to the nearest minute?

\[
\begin{array}{c}
M \\
A \\
S
\end{array}
\]

1. 28°1' 
2. 28°4' 
3. 61°56' 
4. 61°93'

A2.M.1-2: RADIAN MEASURE

290 What is the radian measure of the smaller angle formed by the hands of a clock at 7 o'clock?

1. \( \frac{\pi}{2} \)  
2. \( \frac{2\pi}{3} \)  
3. \( \frac{5\pi}{6} \)  
4. \( \frac{7\pi}{6} \)

291 Find, to the nearest minute, the angle whose measure is 3.45 radians.

292 What is the number of degrees in an angle whose radian measure is \( \frac{11\pi}{12} \)?

1. 150  
2. 165  
3. 330  
4. 518

293 What is the radian measure of an angle whose measure is \(-420^\circ\)?

1. \( \frac{7\pi}{3} \)  
2. \( \frac{7\pi}{6} \)  
3. \( \frac{7\pi}{3} \)  
4. \( \frac{7\pi}{6} \)

294 Find, to the nearest tenth of a degree, the angle whose measure is 2.5 radians.

295 What is the number of degrees in an angle whose radian measure is 2 radians?

1. \( \frac{360}{\pi} \)  
2. \( \frac{\pi}{360} \)  
3. 360  
4. 90

296 Find, to the nearest tenth, the radian measure of 216°.

297 Convert 3 radians to degrees and express the answer to the nearest minute.

298 What is the number of degrees in an angle whose radian measure is \( \frac{8\pi}{5} \)?

1. 576  
2. 288  
3. 225  
4. 113
299  Approximately how many degrees does five radians equal?
1  286
2  900
3  $\frac{\pi}{36}$
4  $5\pi$

A2.A.60: UNIT CIRCLE

300  On the unit circle shown in the diagram below, sketch an angle, in standard position, whose degree measure is 240 and find the exact value of $\sin 240^\circ$.

301  In which graph is $\theta$ coterminal with an angle of $-70^\circ$?
302 If \( m \angle \theta = -50 \), which diagram represents \( \theta \) drawn in standard position?

A2.A.60: FINDING THE TERMINAL SIDE OF AN ANGLE

303 An angle, \( P \), drawn in standard position, terminates in Quadrant II if

1 \( \cos P < 0 \) and \( \csc P < 0 \)
2 \( \sin P > 0 \) and \( \cos P > 0 \)
3 \( \csc P > 0 \) and \( \cot P < 0 \)
4 \( \tan P < 0 \) and \( \sec P > 0 \)

A2.A.56, 62, 66: DETERMINING TRIGONOMETRIC FUNCTIONS

304 In the interval \( 0^\circ \leq x < 360^\circ \), \( \tan x \) is undefined when \( x \) equals

1 0\(^\circ\) and 90\(^\circ\)
2 90\(^\circ\) and 180\(^\circ\)
3 180\(^\circ\) and 270\(^\circ\)
4 90\(^\circ\) and 270\(^\circ\)

305 Express the product of \( \cos 30^\circ \) and \( \sin 45^\circ \) in simplest radical form.

306 If \( \theta \) is an angle in standard position and its terminal side passes through the point \((-3, 2)\), find the exact value of \( \csc \theta \).

307 The value of \( \tan 126^\circ 43' \) to the nearest ten-thousandth is

1 -1.3407
2 -1.3408
3 -1.3548
4 -1.3549

308 Which expression, when rounded to three decimal places, is equal to -1.155?

1 \( \sec \left( \frac{5\pi}{6} \right) \)
2 \( \tan(49^\circ 20') \)
3 \( \sin \left( -\frac{3\pi}{5} \right) \)
4 \( \csc(-118^\circ) \)

309 The value of \( \csc 138^\circ 23' \) rounded to four decimal places is

1 -1.3376
2 -1.3408
3 1.5012
4 1.5057
A2.A.64: USING INVERSE TRIGONOMETRIC FUNCTIONS

310 What is the principal value of \( \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) \)?

1  \(-30^\circ\)
2  \(-60^\circ\)
3  \(-150^\circ\)
4  \(-240^\circ\)

311 In the diagram below of a unit circle, the ordered pair \(\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)\) represents the point where the terminal side of \(\theta\) intersects the unit circle.

312 If \(\sin^{-1}\left(\frac{5}{8}\right) = A\), then

1  \(\sin A = \frac{5}{8}\)
2  \(\sin A = \frac{8}{5}\)
3  \(\cos A = \frac{5}{8}\)
4  \(\cos A = \frac{8}{5}\)

313 If \(\tan\left(\text{Arc cos} \frac{\sqrt{3}}{k}\right) = \frac{\sqrt{3}}{3}\), then \(k\) is

1 1
2 2
3 \(\sqrt{2}\)
4 \(3\sqrt{2}\)

314 If \(\sin A = -\frac{7}{25}\) and \(\angle A\) terminates in Quadrant IV, \(\tan A\) equals

1  \(-\frac{7}{25}\)
2  \(-\frac{7}{24}\)
3  \(-\frac{24}{7}\)
4  \(-\frac{24}{25}\)

A2.A.57: REFERENCE ANGLES

315 Expressed as a function of a positive acute angle, \(\cos(-305^\circ)\) is equal to

1  \(-\cos 55^\circ\)
2  \(\cos 55^\circ\)
3  \(-\sin 55^\circ\)
4  \(\sin 55^\circ\)
A2.A.61: ARC LENGTH

316 A circle has a radius of 4 inches. In inches, what is the length of the arc intercepted by a central angle of 2 radians?
1 $2\pi$
2 2
3 $8\pi$
4 8

317 A circle is drawn to represent a pizza with a 12 inch diameter. The circle is cut into eight congruent pieces. What is the length of the outer edge of any one piece of this circle?
1 $\frac{3\pi}{4}$
2 $\pi$
3 $\frac{3\pi}{2}$
4 $3\pi$

318 Circle $O$ shown below has a radius of 12 centimeters. To the nearest tenth of a centimeter, determine the length of the arc, $x$, subtended by an angle of 83°50'.

A2.A.58-59: COFUNCTION AND RECIPROCAL TRIGONOMETRIC FUNCTIONS

319 If $\angle A$ is acute and $\tan A = \frac{2}{3}$, then
1 $\cot A = \frac{2}{3}$
2 $\cot A = \frac{1}{3}$
3 $\cot(90^\circ - A) = \frac{2}{3}$
4 $\cot(90^\circ - A) = \frac{1}{3}$

320 The expression $\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta}$ is equivalent to
1 $\cos^2 \theta$
2 $\sin^2 \theta$
3 $sec^2 \theta$
4 $csc^2 \theta$

321 Express $\cos \theta (\sec \theta - \cos \theta)$, in terms of $\sin \theta$.

322 If $\sec(a + 15)^\circ = \csc(2a)^\circ$, find the smallest positive value of $a$, in degrees.

323 Express $\frac{\cot x \sin x}{\sec x}$ as a single trigonometric function, in simplest form, for all values of $x$ for which it is defined.

324 Show that $\sec \theta \sin \theta \cot \theta = 1$ is an identity.

325 Express the exact value of $\csc 60^\circ$, with a rational denominator.

A2.A.67: PROVING TRIGONOMETRIC IDENTITIES

326 Starting with $\sin^2 A + \cos^2 A = 1$, derive the formula $\tan^2 A + 1 = \sec^2 A$. 
327 Which expression always equals 1?
1) \( \cos^2 x - \sin^2 x \)
2) \( \cos^2 x + \sin^2 x \)
3) \( \cos x - \sin x \)
4) \( \cos x + \sin x \)

A2.A.76: ANGLE SUM AND DIFFERENCE IDENTITIES

328 The expression \( \cos 4x \cos 3x + \sin 4x \sin 3x \) is equivalent to
1) \( \sin x \)
2) \( \sin 7x \)
3) \( \cos x \)
4) \( \cos 7x \)

329 If \( \tan A = \frac{2}{3} \) and \( \sin B = \frac{5}{\sqrt{41}} \) and angles \( A \) and \( B \) are in Quadrant I, find the value of \( \tan(A + B) \).

330 Express as a single fraction the exact value of \( \sin 75^\circ \).

331 Given angle \( A \) in Quadrant I with \( \sin A = \frac{12}{13} \) and angle \( B \) in Quadrant II with \( \cos B = -\frac{3}{5} \), what is the value of \( \cos(A - B) \)?
1) \( \frac{33}{65} \)
2) \( \frac{33}{65} \)
3) \( \frac{63}{65} \)
4) \( \frac{63}{65} \)

332 The value of \( \sin(180 + x) \) is equivalent to
1) \( -\sin x \)
2) \( -\sin(90 - x) \)
3) \( \sin x \)
4) \( \sin(90 - x) \)

A2.A.77: DOUBLE AND HALF ANGLE IDENTITIES

333 The expression \( \sin(\theta + 90)^\circ \) is equivalent to
1) \( -\sin \theta \)
2) \( -\cos \theta \)
3) \( \sin \theta \)
4) \( \cos \theta \)

334 The expression \( \cos^2 \theta - \cos 2\theta \) is equivalent to
1) \( \sin^2 \theta \)
2) \( -\sin^2 \theta \)
3) \( \cos^2 \theta + 1 \)
4) \( -\cos^2 \theta - 1 \)

335 If \( \sin A = \frac{2}{3} \) where \( 0^\circ < A < 90^\circ \), what is the value of \( \sin 2A \)?
1) \( \frac{2\sqrt{5}}{3} \)
2) \( \frac{2\sqrt{5}}{9} \)
3) \( \frac{4\sqrt{5}}{9} \)
4) \( -\frac{4\sqrt{5}}{9} \)

336 What is a positive value of \( \tan \frac{1}{2} x \), when \( \sin x = 0.8 \)?
1) 0.5
2) 0.4
3) 0.33
4) 0.25

337 If \( \sin A = \frac{1}{3} \), what is the value of \( \cos 2A \)?
1) \( \frac{2}{3} \)
2) \( \frac{2}{3} \)
3) \( \frac{7}{9} \)
4) \( \frac{7}{9} \)
A2.A.68: TRIGONOMETRIC EQUATIONS

338 What are the values of \( \theta \) in the interval \( 0^\circ \leq \theta < 360^\circ \) that satisfy the equation 
\[
\tan \theta - \sqrt{3} = 0
\]
1 60°, 240°
2 72°, 252°
3 72°, 108°, 252°, 288°
4 60°, 120°, 240°, 300°

339 Find all values of \( \theta \) in the interval \( 0^\circ \leq \theta < 360^\circ \) that satisfy the equation \( \sin 2\theta = \sin \theta \).

340 Solve the equation \( 2 \tan C - 3 = 3 \tan C - 4 \) algebraically for all values of \( C \) in the interval \( 0^\circ \leq C < 360^\circ \).

341 What is the solution set for \( 2 \cos \theta - 1 = 0 \) in the interval \( 0^\circ \leq \theta < 360^\circ \)?
1 \( \{30^\circ, 150^\circ\} \)
2 \( \{60^\circ, 120^\circ\} \)
3 \( \{30^\circ, 330^\circ\} \)
4 \( \{60^\circ, 300^\circ\} \)

342 What is the solution set of the equation 
\[-\sqrt{2} \sec x = 2 \text{ when } 0^\circ \leq x < 360^\circ ?
\]
1 \( \{45^\circ, 135^\circ, 225^\circ, 315^\circ\} \)
2 \( \{45^\circ, 315^\circ\} \)
3 \( \{135^\circ, 225^\circ\} \)
4 \( \{225^\circ, 315^\circ\} \)

343 Find, algebraically, the measure of the obtuse angle, to the nearest degree, that satisfies the equation \( 5 \csc \theta = 8 \).

344 Solve algebraically for all exact values of \( x \) in the interval \( 0 \leq x < 2\pi \): \( 2 \sin^2x + 5 \sin x = 3 \)

A2.A.69: PROPERTIES OF TRIGONOMETRIC FUNCTIONS

345 What is the period of the function 
\[
y = \frac{1}{2} \sin \left( \frac{x}{3} - \pi \right)
\]
1 \( \frac{1}{2} \)
2 \( \frac{1}{3} \)
3 \( \frac{2}{3} \pi \)
4 \( 6\pi \)

346 What is the period of the function \( f(\theta) = -2 \cos 3\theta \)?
1 \( \pi \)
2 \( \frac{2\pi}{3} \)
3 \( \frac{3\pi}{2} \)
4 \( 2\pi \)

347 Which equation represents a graph that has a period of \( 4\pi \)?
1 \( y = 3 \sin \frac{1}{2}x \)
2 \( y = 3 \sin 2x \)
3 \( y = 3 \sin \frac{1}{4}x \)
4 \( y = 3 \sin 4x \)
348 Which equation is graphed in the diagram below?

1. $y = 3\cos\left(\frac{\pi}{30}x\right) + 8$
2. $y = 3\cos\left(\frac{\pi}{15}x\right) + 5$
3. $y = -3\cos\left(\frac{\pi}{30}x\right) + 8$
4. $y = -3\cos\left(\frac{\pi}{15}x\right) + 5$

349 Write an equation for the graph of the trigonometric function shown below.

350 Which equation is represented by the graph below?

1. $y = 2\cos 3x$
2. $y = 2\sin 3x$
3. $y = 2\cos \frac{2\pi}{3}x$
4. $y = 2\sin \frac{2\pi}{3}x$

351 Which equation represents the graph below?

1. $y = -2\sin 2x$
2. $y = -2\sin \frac{1}{2}x$
3. $y = -2\cos 2x$
4. $y = -2\cos \frac{1}{2}x$
352 Which graph represents the equation \( y = \cos^{-1}x \)?

353 Which graph shows \( y = \cos^{-1}x \)?
354 Which graph represents one complete cycle of the equation \( y = \sin 3\pi x \)?

355 Which equation is represented by the graph below?

\[
\begin{align*}
1 & \quad y = \cot x \\
2 & \quad y = \csc x \\
3 & \quad y = \sec x \\
4 & \quad y = \tan x
\end{align*}
\]

356 Which equation is sketched in the diagram below?

\[
\begin{align*}
1 & \quad y = \csc x \\
2 & \quad y = \sec x \\
3 & \quad y = \cot x \\
4 & \quad y = \tan x
\end{align*}
\]
357 Which is a graph of \( y = \cot x \)?

1

2

3

4

A2.A.63: DOMAIN AND RANGE

358 The function \( f(x) = \tan x \) is defined in such a way that \( f^{-1}(x) \) is a function. What can be the domain of \( f(x) \)?

1 \( \{x|0 \leq x \leq \pi\} \)

2 \( \{x|0 \leq x \leq 2\pi\} \)

3 \( \left\{ x|\frac{-\pi}{2} < x < \frac{\pi}{2} \right\} \)

4 \( \left\{ x|\frac{-\pi}{2} < x < \frac{3\pi}{2} \right\} \)

359 In which interval of \( f(x) = \cos(x) \) is the inverse also a function?

1 \( \frac{-\pi}{2} < x < \frac{\pi}{2} \)

2 \( \frac{-\pi}{2} \leq x \leq \frac{\pi}{2} \)

3 \( 0 \leq x \leq \pi \)

4 \( \frac{\pi}{2} \leq x \leq \frac{3\pi}{2} \)

A2.A.74: USING TRIGONOMETRY TO FIND AREA

360 In \( \triangle ABC \), \( m\angle A = 120 \), \( b = 10 \), and \( c = 18 \). What is the area of \( \triangle ABC \) to the nearest square inch?

1 52

2 78

3 90

4 156

361 Two sides of a parallelogram are 24 feet and 30 feet. The measure of the angle between these sides is 57°. Find the area of the parallelogram, to the nearest square foot.

362 The sides of a parallelogram measure 10 cm and 18 cm. One angle of the parallelogram measures 46 degrees. What is the area of the parallelogram, to the nearest square centimeter?

1 65

2 125

3 129

4 162

363 In parallelogram \( BFLO \), \( OL = 3.8 \), \( LF = 7.4 \), and \( m\angle O = 126 \). If diagonal \( BL \) is drawn, what is the area of \( \triangle BLF \)?

1 11.4

2 14.1

3 22.7

4 28.1

364 The two sides and included angle of a parallelogram are 18, 22, and 60°. Find its exact area in simplest form.
365 The area of triangle $ABC$ is 42. If $AB = 8$ and $m\angle B = 61$, the length of $BC$ is approximately
1 5.1
2 9.2
3 12.0
4 21.7

366 A ranch in the Australian Outback is shaped like triangle $ACE$, with $m\angle A = 42$, $m\angle E = 103$, and $AC = 15$ miles. Find the area of the ranch, to the nearest square mile.

367 Find, to the nearest tenth of a square foot, the area of a rhombus that has a side of 6 feet and an angle of 50°.

A2.A.73: LAW OF SINES

368 In $\triangle ABC$, $m\angle A = 32$, $a = 12$, and $b = 10$. Find the measures of the missing angles and side of $\triangle ABC$. Round each measure to the nearest tenth.

369 The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65 degrees with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is 32 degrees. Find the height of the tower, to the nearest foot.

A2.A.75: LAW OF SINES-THE AMBIGUOUS CASE

370 As shown in the diagram below, fire-tracking station $A$ is 100 miles due west of fire-tracking station $B$. A forest fire is spotted at $F$, on a bearing $47^\circ$ northeast of station $A$ and 15° northeast of station $B$. Determine, to the nearest tenth of a mile, the distance the fire is from both station $A$ and station $B$. [N represents due north.]

371 In $\triangle PQR$, $p$ equals
1 $\frac{r \sin P}{\sin Q}$
2 $\frac{r \sin P}{\sin R}$
3 $\frac{r \sin R}{\sin P}$
4 $\frac{q \sin R}{\sin Q}$

A2.A.75: LAW OF SINES-THE AMBIGUOUS CASE

372 In $\triangle ABC$, $m\angle A = 74$, $a = 59.2$, and $c = 60.3$. What are the two possible values for $m\angle C$, to the nearest tenth?
1 73.7 and 106.3
2 73.7 and 163.7
3 78.3 and 101.7
4 78.3 and 168.3

373 How many distinct triangles can be formed if $m\angle A = 35$, $a = 10$, and $b = 13$?
1 1
2 2
3 3
4 0
374 Given $\triangle ABC$ with $a = 9$, $b = 10$, and $m\angle B = 70$, what type of triangle can be drawn?
1. an acute triangle, only
2. an obtuse triangle, only
3. both an acute triangle and an obtuse triangle
4. neither an acute triangle nor an obtuse triangle

375 In $\triangle MNP$, $m = 6$ and $n = 10$. Two distinct triangles can be constructed if the measure of angle $M$ is
1. $35$
2. $40$
3. $45$
4. $50$

376 In $\triangle KLM$, $KL = 20$, $LM = 13$, and $m\angle K = 40$. The measure of $M$?
1. must be between $0^\circ$ and $90^\circ$
2. must equal $90^\circ$
3. must be between $90^\circ$ and $180^\circ$
4. is ambiguous

377 In $\triangle DEF$, $d = 5$, $e = 8$, and $m\angle D = 32$. How many distinct triangles can be drawn given these measurements?
1. 1
2. 2
3. 3
4. 0

A2.A.73: LAW OF COSINES

378 In a triangle, two sides that measure 6 cm and 10 cm form an angle that measures $80^\circ$. Find, to the nearest degree, the measure of the smallest angle in the triangle.

379 In $\triangle ABC$, $a = 3$, $b = 5$, and $c = 7$. What is $m\angle C$?
1. 22
2. 38
3. 60
4. 120

380 In $\triangle ABC$, $a = 15$, $b = 14$, and $c = 13$, as shown in the diagram below. What is the $m\angle C$, to the nearest degree?

A2.A.73: VECTORS

381 Two sides of a parallelogram measure 27 cm and 32 cm. The included angle measures $48^\circ$. Find the length of the longer diagonal of the parallelogram, to the nearest centimeter.

382 Two forces of 25 newtons and 85 newtons acting on a body form an angle of $55^\circ$. Find the magnitude of the resultant force, to the nearest hundredth of a newton. Find the measure, to the nearest degree, of the angle formed between the resultant and the larger force.

383 The measures of the angles between the resultant and two applied forces are $60^\circ$ and $45^\circ$, and the magnitude of the resultant is 27 pounds. Find, to the nearest pound, the magnitude of each applied force.
**CONICS**

**A2.A.47, 49: EQUATIONS OF CIRCLES**

384 The equation \(x^2 + y^2 - 2x + 6y + 3 = 0\) is equivalent to

1. \((x - 1)^2 + (y + 3)^2 = -3\)
2. \((x - 1)^2 + (y + 3)^2 = 7\)
3. \((x + 1)^2 + (y + 3)^2 = 7\)
4. \((x + 1)^2 + (y + 3)^2 = 10\)

385 What are the coordinates of the center of a circle whose equation is \(x^2 + y^2 - 16x + 6y + 53 = 0\)?

1. \((-8, -3)\)
2. \((-8, 3)\)
3. \((8, -3)\)
4. \((8, 3)\)

386 Write an equation of the circle shown in the graph below.

387 A circle shown in the diagram below has a center of \((-5, 3)\) and passes through point \((-1, 7)\).

Write an equation that represents the circle.

388 Which equation represents the circle shown in the graph below that passes through the point \((0, -1)\)?

1. \((x - 3)^2 + (y + 4)^2 = 16\)
2. \((x - 3)^2 + (y + 4)^2 = 18\)
3. \((x + 3)^2 + (y - 4)^2 = 16\)
4. \((x + 3)^2 + (y - 4)^2 = 18\)
389 Write an equation of the circle shown in the diagram below.

390 Which equation is represented by the graph below?

1 \((x - 3)^2 + (y + 1)^2 = 5\)
2 \((x + 3)^2 + (y - 1)^2 = 5\)
3 \((x - 1)^2 + (y + 3)^2 = 13\)
4 \((x + 3)^2 + (y - 1)^2 = 13\)
Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic
Answer Section

1 ANS:
Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

PTS: 2 REF: 081030a2 STA: A2.S.1 TOP: Analysis of Data

2 ANS: 4 PTS: 2 REF: 011127a2 STA: A2.S.1 TOP: Analysis of Data

3 ANS: 4 PTS: 2 REF: 061101a2 STA: A2.S.1 TOP: Analysis of Data

4 ANS: 2 PTS: 2 REF: 061301a2 STA: A2.S.1 TOP: Analysis of Data

5 ANS: 4 PTS: 2 REF: 011406a2 STA: A2.S.1 TOP: Analysis of Data

6 ANS: 4
Students entering the library are more likely to spend more time studying, creating bias.

PTS: 2 REF: fall0904a2 STA: A2.S.2 TOP: Analysis of Data

7 ANS: 4 PTS: 2 REF: 011201a2 STA: A2.S.2 TOP: Analysis of Data

8 ANS: 4 PTS: 2 REF: 061124a2 STA: A2.S.3 TOP: Average Known with Missing Data

9 ANS: 4
\[
\begin{align*}
4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5 &= 2 \\
\frac{4k + 36}{k + 22} &= 2 \\
4k + 36 &= 2k + 44 \\
2k &= 8 \\
k &= 4
\end{align*}
\]

PTS: 2 REF: 061221a2 STA: A2.S.3 TOP: Average Known with Missing Data

10 ANS:
7.4

PTS: 2 REF: 061029a2 STA: A2.S.4 TOP: Dispersion

KEY: basic, group frequency distributions
11 ANS: 3

\[ I-\text{Var Stats L}_1, L_n \]
\[ 0x^2 \]
\[ 67.31102041 \]

PTS: 2  
REF: fall0924a2  
STA: A2.S.4  
TOP: Dispersion

KEY: range, quartiles, interquartile range, variance

12 ANS:
\[ \sigma_x = 14.9. \]  
\[ x = 40. \]  
There are 8 scores between 25.1 and 54.9.

PTS: 4  
REF: 061237a2  
STA: A2.S.4  
TOP: Dispersion

KEY: advanced

13 ANS:

Ordered, the heights are 71, 71, 72, 74, 74, 75, 78, 79, 79, 83.  
\[ Q_1 = 72 \text{ and } Q_3 = 79. \]  
\[ 79 - 72 = 7. \]

PTS: 2  
REF: 011331a2  
STA: A2.S.4  
TOP: Dispersion

KEY: range, quartiles, interquartile range, variance

14 ANS:
\[ \sigma_x \approx 6.2. \]  
6 scores are within a population standard deviation of the mean.  
\[ Q_3 - Q_1 = 41 - 37 = 4 \]
\[ x \approx 38.2 \]

PTS: 4  
REF: 061338a2  
STA: A2.S.4  
TOP: Dispersion

KEY: advanced

15 ANS:

\[ Q_1 = 3.5 \text{ and } Q_3 = 10.5. \]  
10.5 − 3.5 = 7.

PTS: 2  
REF: 011430a2  
STA: A2.S.4  
TOP: Dispersion

KEY: range, quartiles, interquartile range, variance

16 ANS: 3  
PTS: 2  
REF: 061127a2  
STA: A2.S.6

TOP: Regression

17 ANS:
\[ y = 2.001x^{2.298}, \]  
1,009.  
\[ y = 2.001(15)^{2.298} \approx 1009 \]

PTS: 4  
REF: fall0938a2  
STA: A2.S.7  
TOP: Power Regression

18 ANS:
\[ y = 10.596(1.586)^x \]

PTS: 2  
REF: 081031a2  
STA: A2.S.7  
TOP: Exponential Regression

19 ANS:
\[ y = 27.2025(1.1509)^x. \]  
\[ y = 27.2025(1.1509)^{18} \approx 341 \]

PTS: 4  
REF: 011238a2  
STA: A2.S.7  
TOP: Exponential Regression

2
20 ANS:
\[ y = 180.377(0.954)^x \]

PTS: 2  REF: 061231a2  STA: A2.S.7  TOP: Exponential Regression

21 ANS:
\[ y = 215.983(1.652)^x. \]  \[ 215.983(1.652)^7 \approx 7250 \]

PTS: 4  REF: 011337a2  STA: A2.S.7  TOP: Exponential Regression

22 ANS: 2  PTS: 2  REF: 061021a2  STA: A2.S.8
TOP: Correlation Coefficient

23 ANS: 1
(4) shows the strongest linear relationship, but if \( r < 0, b < 0 \). The Regents announced that a correct solution was not provided for this question and all students should be awarded credit.

PTS: 2  REF: 011223a2  STA: A2.S.8  TOP: Correlation Coefficient

24 ANS: 1

PTS: 2  REF: 061225a2  STA: A2.S.8  TOP: Correlation Coefficient

25 ANS: 2
Since the coefficient of \( t \) is greater than 0, \( r > 0 \).

PTS: 2  REF: 011303a2  STA: A2.S.8  TOP: Correlation Coefficient

26 ANS: 1  PTS: 2  REF: 061316a2  STA: A2.S.8
TOP: Correlation Coefficient

27 ANS: 1

PTS: 2  REF: fall0915a2  STA: A2.S.5  TOP: Normal Distributions
KEY: interval

28 ANS: 3
\[ 68\% \times 50 = 34 \]

PTS: 2  REF: 081013a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict
29 ANS:
68% of the students are within one standard deviation of the mean. 16% of the students are more than one standard deviation above the mean.

PTS: 2  REF: 011134a2  STA: A2.S.5  TOP: Normal Distributions
KEY: percent

30 ANS:
no. over 20 is more than 1 standard deviation above the mean. 0.159 \cdot 82 \approx 13.038

PTS: 2  REF: 061129a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict

31 ANS: 3
34.1% + 19.1% = 53.2%

PTS: 2  REF: 011212a2  STA: A2.S.5  TOP: Normal Distributions
KEY: probability

32 ANS: 2
\[ \bar{x} \pm \sigma \]
153 \pm 22
131 - 175

PTS: 2  REF: 011307a2  STA: A2.S.5  TOP: Normal Distributions
KEY: interval

33 ANS: 2
Top 6.7% = 1.5 s.d. \[ + \sigma = 1.5(104) + 576 = 732 \]

PTS: 2  REF: 011420a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict

34 ANS: 4
PTS: 2  REF: fall0925a2  STA: A2.S.10
TOP: Permutations

35 ANS:
No. TENNESSEE:
\[ \frac{9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780 \] VERMONT:
\[ 7P_7 = 5,040 \]

PTS: 4  REF: 061038a2  STA: A2.S.10  TOP: Permutations

36 ANS:
39,916,800.
\[ \frac{11P_3}{3! \cdot 2!} = \frac{479,001,600}{12} = 39,916,800 \]

PTS: 2  REF: 081035a2  STA: A2.S.10  TOP: Permutations

37 ANS: 1
8 \times 8 \times 7 \times 1 = 448. The first digit cannot be 0 or 5. The second digit cannot be 5 or the same as the first digit. The third digit cannot be 5 or the same as the first or second digit.

PTS: 2  REF: 011125a2  STA: A2.S.10  TOP: Permutations
38 ANS: 1
\[
\frac{6!}{3!} = \frac{720}{12} = 60
\]
PTS: 2 REF: 011324a2 STA: A2.S.10 TOP: Permutations

39 ANS:
\[
\frac{10!}{3! \cdot 3! \cdot 2!} = \frac{3,628,800}{72} = 50,400
\]
PTS: 2 REF: 061330a2 STA: A2.S.10 TOP: Permutations

40 ANS: 4 PTS: 2 REF: 011409a2 STA: A2.S.10 TOP: Permutations

41 ANS: 2
\[
\binom{15}{8} = 6,435
\]
PTS: 2 REF: 081012a2 STA: A2.S.11 TOP: Combinations

42 ANS: 1
\[
\binom{10}{4} = 210
\]
PTS: 2 REF: 061113a2 STA: A2.S.11 TOP: Combinations

43 ANS:
\[
\binom{25}{20} = 53,130
\]
PTS: 2 REF: 011232a2 STA: A2.S.11 TOP: Combinations

44 ANS: 4
\[
\binom{15}{5} = 3,003 \quad \binom{25}{5} = 25,130 \quad \binom{25}{20} = 53,130 \quad \binom{25}{15} = 3,268,760.
\]
PTS: 2 REF: 061227a2 STA: A2.S.11 TOP: Combinations

45 ANS: 3 PTS: 2 REF: 061007a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

46 ANS: 1 PTS: 2 REF: 011117a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

47 ANS: 1 PTS: 2 REF: 011310a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

48 ANS: 1 PTS: 2 REF: 061317a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

49 ANS: 2 PTS: 2 REF: 011417a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations
50 ANS:

\[ \binom{30}{2} \times 20 \cdot \binom{3}{1} = 41040. \]

PTS: 2  REF: fall0935a2  STA: A2.S.12  TOP: Sample Space

51 ANS: 2

\[ \frac{\pi/3 + \pi/3}{2\pi} = \frac{2\pi}{6\pi} = \frac{1}{3}. \]

PTS: 2  REF: 011108a2  STA: A2.S.13  TOP: Geometric Probability

52 ANS:

\[ 0.167. 10 C_8 \cdot 0.6^8 \cdot 0.4^2 + 10 C_9 \cdot 0.6^9 \cdot 0.4^1 + 10 C_{10} \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167 \]


KEY: at least or at most

53 ANS:

\[ 26.2\%. 10 C_8 \cdot 0.65^8 \cdot 0.35^2 + 10 C_9 \cdot 0.65^9 \cdot 0.35^1 + 10 C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262 \]


KEY: at least or at most

54 ANS:

\[ 0.468. 8 C_6 \left( \frac{2}{3} \right)^6 \left( \frac{1}{3} \right)^2 \approx 0.27313. 8 C_7 \left( \frac{2}{3} \right)^7 \left( \frac{1}{3} \right)^1 \approx 0.15607. 8 C_8 \left( \frac{2}{3} \right)^8 \left( \frac{1}{3} \right)^0 \approx 0.03902. \]


KEY: at least or at most
55 ANS:
\[
\binom{51}{243} \cdot \binom{3}{5} \left( \frac{2}{3} \right)^2 = \frac{40}{243}
\]
\[
\binom{243}{3} \left( \frac{2}{3} \right)^1 = \frac{10}{243}
\]
\[
\binom{243}{3} \left( \frac{2}{3} \right)^0 = \frac{1}{243}
\]

PTS: 4  
REF: 061138a2  
STA: A2.S.15  
TOP: Binomial Probability

KEY: at least or at most

56 ANS: 4
\[
\binom{5}{2} \left( \frac{3}{8} \right)^1 = \frac{225}{512}
\]

PTS: 2  
REF: 011221a2  
STA: A2.S.15  
TOP: Binomial Probability

KEY: spinner

57 ANS: 1  
PTS: 2  
REF: 061223a2  
STA: A2.S.15

TOP: Binomial Probability  
KEY: modeling

58 ANS:
\[
\binom{3}{4} \left( \frac{3}{4} \right)^4 = 35 \left( \frac{1}{64} \right) \left( \frac{81}{256} \right) = \frac{2835}{16384} \approx 0.173
\]

PTS: 2  
REF: 061335a2  
STA: A2.S.15  
TOP: Binomial Probability

KEY: exactly

59 ANS:
\[
\binom{4}{2} \cdot 0.28^4 \cdot 0.72^1 + \binom{5}{2} \cdot 0.28^5 \cdot 0.72^0 \approx 0.024
\]

PTS: 4  
REF: 011437a2  
STA: A2.S.15  
TOP: Binomial Probability

KEY: at least or at most

60 ANS: 1
\[
4a + 6 = 4a - 10. \quad 4a + 6 = -4a + 10. \quad \left| 4 \left( \frac{1}{2} \right) + 6 \right| - 4 \left( \frac{1}{2} \right) = -10
\]
\[
6 \neq -10 \quad \quad 8a = 4 \quad \quad 8a = \frac{4}{8} = \frac{1}{2}
\]
\[
\quad 8 - 2 \neq -10
\]

PTS: 2  
REF: 011106a2  
STA: A2.A.1  
TOP: Absolute Value Equations
61 ANS: 1
6x - 7 ≤ 5  6x - 7 ≥ -5
  6x ≤ 12   6x ≥ 2
    x ≤ 2   x ≥ 1/3

PTS: 2   REF: fall0905a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

62 ANS:
-3|6 - x| < -15
  |6 - x| > 5
6 - x > 5 or 6 - x < -5
  1 > x or 11 < x

PTS: 2   REF: 061137a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

63 ANS: 3
4x - 5/3 > 1 or 4x - 5/3 < -1
  4x - 5 > 3  4x - 5 < -3
  4x > 8  4x < 2
    x > 2  x < 1/2

PTS: 2   REF: 061209a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

64 ANS:
3 - 2x ≥ 7 or 3 - 2x ≤ -7
  -2x ≥ 4  -2x ≤ -10
    x ≤ -2  x ≥ 5

PTS: 2   REF: 011334a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

65 ANS: 1
2x - 1 > 5.  2x - 1 < -5
  2x > 6  2x > -4
    x > 3  x < -2

PTS: 2   REF: 061307a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph
66 ANS:
\[-4x + 5 < 13 \quad -4x + 5 > -13 \quad -2 < x < 4.5\]
\[-4x < 8 \quad -4x > -18\]
\[x > -2 \quad x < 4.5\]

PTS: 2 REF: 011432a2 STA: A2.A.1 TOP: Absolute Value Inequalities

67 ANS:
\[\text{Sum } \frac{-b}{a} = -\frac{11}{5}, \quad \text{Product } \frac{c}{a} = -\frac{3}{5}\]

PTS: 2 REF: 061030a2 STA: A2.A.20 TOP: Roots of Quadratics

68 ANS: 2
\[
\text{sum: } \frac{-b}{a} = \frac{4}{6} = \frac{2}{3}, \quad \text{product: } \frac{c}{a} = -\frac{12}{6} = -2
\]

PTS: 2 REF: 011209a2 STA: A2.A.20 TOP: Roots of Quadratics

69 ANS:
\[3x^2 - 11x + 6 = 0. \quad \text{Sum } \frac{-b}{a} = \frac{11}{3}, \quad \text{Product } \frac{c}{a} = \frac{6}{3} = 2\]

PTS: 2 REF: 011329a2 STA: A2.A.20 TOP: Roots of Quadratics

70 ANS:
\[\text{Sum } \frac{-b}{a} = -\frac{1}{12}, \quad \text{Product } \frac{c}{a} = -\frac{1}{2}\]

PTS: 2 REF: 061328a2 STA: A2.A.20 TOP: Roots of Quadratics

71 ANS: 3
\[S = \frac{-b}{a} = \frac{-(-3)}{4} = \frac{3}{4}, \quad P = \frac{c}{a} = \frac{-8}{4} = -2\]

PTS: 2 REF: fall0912a2 STA: A2.A.21 TOP: Roots of Quadratics

KEY: basic

72 ANS: 3
\[\frac{-b}{a} = \frac{-6}{2} = -3, \quad \frac{c}{a} = \frac{4}{2} = 2\]

PTS: 2 REF: 011121a2 STA: A2.A.21 TOP: Roots of Quadratics

KEY: basic

73 ANS:
\[x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \quad \text{If } a = 1 \text{ then } b = -6 \text{ and } c = -27\]

PTS: 4 REF: 061130a2 STA: A2.A.21 TOP: Roots of Quadratics

KEY: basic
74 ANS: 3
sum of the roots, \( \frac{-b}{a} = \frac{(-9)}{4} = \frac{9}{4} \). product of the roots, \( \frac{c}{a} = \frac{3}{4} \)

PTS: 2 REF: 061208a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

75 ANS: 3
\[-\frac{b}{a} = \frac{(-4)}{1} = 4.\] If the sum is 4, the roots must be 7 and \(-3\).

PTS: 2 REF: 011418a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: advanced

76 ANS: 4
\[6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2)\]

PTS: 2 REF: fall0917a2 STA: A2.A.7 TOP: Factoring Polynomials
KEY: single variable

77 ANS: 4
\[12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2)\]

PTS: 2 REF: 061008a2 STA: A2.A.7 TOP: Factoring Polynomials
KEY: single variable

78 ANS:
\[10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5)\]

PTS: 2 REF: 081028a2 STA: A2.A.7 TOP: Factoring Polynomials
KEY: multiple variables

79 ANS:
\[12t^8 - 75t^4 = 3t^4(4t^4 - 25) = 3t^4(2t^2 + 5)(2t^2 - 5)\]

PTS: 2 REF: 061133a2 STA: A2.A.7 TOP: Factoring the Difference of Perfect Squares KEY: binomial

80 ANS: 2
\[x^3 + 3x^2 - 4x - 12\]
\[x^2(x + 3) - 4(x + 3)\]
\[(x^2 - 4)(x + 3)\]
\[(x + 2)(x - 2)(x + 3)\]

PTS: 2 REF: 061214a2 STA: A2.A.7 TOP: Factoring by Grouping
81 ANS: 3
\[3x^3 - 5x^2 - 48x + 80\]
\[x^2(3x - 5) - 16(3x - 5)\]
\[(x^2 - 16)(3x - 5)\]
\[(x + 4)(x - 4)(3x - 5)\]

PTS: 2 REF: 011317a2 STA: A2.A.7 TOP: Factoring by Grouping

82 ANS: 4
\[x^2(x + 2) - (x + 2)\]
\[(x^2 - 1)(x + 2)\]
\[(x + 1)(x - 1)(x + 2)\]

PTS: 2 REF: 011426a2 STA: A2.A.7 TOP: Factoring by Grouping

83 ANS: 4
\[\frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2}\]

PTS: 2 REF: 061009a2 STA: A2.A.25 TOP: Quadratic Formula

84 ANS: 3
\[\frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)} = \frac{-7 \pm \sqrt{73}}{4}\]

PTS: 2 REF: 081009a2 STA: A2.A.25 TOP: Quadratic Formula

85 ANS:
\[\frac{2 \pm \sqrt{(-2)^2 - 4(6)(-3)}}{2(6)} = \frac{2 \pm \sqrt{76}}{12} = \frac{2 \pm 2\sqrt{19}}{12} = \frac{1 \pm \sqrt{19}}{6}\]

PTS: 2 REF: 011332a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

86 ANS:
\[b^2 - 4ac = 0\]
\[k^2 - 4(1)(4) = 0\]
\[k^2 - 16 = 0\]
\[(k + 4)(k - 4) = 0\]
\[k = \pm 4\]

PTS: 2 REF: 061028a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine equation given nature of roots
87 ANS: 4
\[ b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153 \]

PTS: 2 REF: 081016a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

88 ANS: 3
\[ b^2 - 4ac = (-10)^2 - 4(1)(25) = 100 - 100 = 0 \]

PTS: 2 REF: 011102a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

89 ANS: 4 PTS: 2 REF: 011323a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

90 ANS: 2
\[ b^2 - 4ac = (-9)^2 - 4(2)(4) = 81 - 32 = 49 \]

PTS: 2 REF: 011411a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

91 ANS:
\[ 3 \pm \sqrt{7}. \quad 2x^2 - 12x + 4 = 0 \]
\[ x^2 - 6x + 2 = 0 \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]
\[ x - 3 = \pm \sqrt{7} \]
\[ x = 3 \pm \sqrt{7} \]

PTS: 4 REF: fall0936a2 STA: A2.A.24 TOP: Completing the Square

92 ANS: 2
\[ x^2 + 2 = 6x \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]

PTS: 2 REF: 011116a2 STA: A2.A.24 TOP: Completing the Square

93 ANS: 2 PTS: 2 REF: 061122a2 STA: A2.A.24 TOP: Completing the Square
TOP: Completing the Square
94 ANS: 2
\[(x + 2)^2 = -9\]
\[x + 2 = \pm \sqrt{-9}\]
\[x = -2 \pm 3i\]

PTS: 2  REF: 011408a2  STA: A2.A.24  TOP: Completing the Square

95 ANS: 1
\[y \geq x^2 - x - 6\]
\[y \geq (x - 3)(x + 2)\]

PTS: 2  REF: 061017a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: two variables

96 ANS: 3
\[x^2 - 3x - 10 > 0\]
\[(x - 5)(x + 2) > 0\]
\[x - 5 > 0 \text{ and } x + 2 > 0\]
\[x > 5 \text{ and } x > -2\]
\[x > 5\]

PTS: 2  REF: 011115a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

97 ANS:
\[x < -1 \text{ or } x > 5.\]
\[x^2 - 4x - 5 > 0.\]
\[x - 5 > 0 \text{ and } x + 1 > 0 \text{ or } x - 5 < 0 \text{ and } x + 1 < 0\]
\[(x - 5)(x + 1) > 0\]
\[x > 5 \text{ and } x > -1\]
\[x < 5 \text{ and } x < -1\]
\[x > 5\]
\[x < -1\]

PTS: 2  REF: 011228a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

98 ANS: 2
\[x^2 - x - 6 = 3x - 6\]
\[x^2 - 4x = 0\]
\[x(x - 4) = 0\]
\[x = 0, 4\]

PTS: 2  REF: 081015a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations
99 ANS: 
\[ \left( -\frac{9}{2}, \frac{1}{2} \right) \text{ and } \left( \frac{1}{2}, \frac{11}{2} \right) \].  
\[ y = x + 5 \] and \[ x^2 + 17x - 4 = x + 5 \]  
\[ y = 4x^2 + 17x - 4 \] and \[ 4x^2 + 16x - 9 = 0 \]  
\[ 2x + 9 \neq 2x - 1 \]  
\[ x = -\frac{9}{2} \text{ and } x = \frac{1}{2} \]  
\[ y = -\frac{9}{2} + 5 = \frac{1}{2} \text{ and } y = \frac{1}{2} + 5 = \frac{11}{2} \]

PTS: 6  REF: 061139a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations

100 ANS: 3  
\[ x + y = 5 \] and \[ -5 + y = 5 \]  
\[ y = -x + 5 \] and \[ y = 10 \]  
\[ (x + 3)^2 + (-x + 5 - 3)^2 = 53 \]  
\[ x^2 + 6x + 9 + x^2 - 4x + 4 = 53 \]  
\[ 2x^2 + 2x - 40 = 0 \]  
\[ x^2 + x - 20 = 0 \]  
\[ (x + 5)(x - 4) = 0 \]  
\[ x = -5, 4 \]

PTS: 2  REF: 011302a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations

101 ANS: 4  
\[ x = 2y \] and \[ y^2 - (3y)^2 + 32 = 0 \]  
\[ x = 3(-2) = -6 \]  
\[ y^2 - 9y^2 = -32 \]  
\[ -8y^2 = -32 \]  
\[ y^2 = 4 \]  
\[ y = \pm 2 \]

PTS: 2  REF: 061312a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations
102 ANS:
\[ x(x + 3) = 10 \]
\[ x^2 + 3x - 10 = 0 \]
\[ (x + 5)(x - 2) = 0 \]
\[ x = -5, 2 \]

PTS: 2  REF: 011431a2  STA: A2.A.3  TOP: Quadratic-Linear Systems

KEY: equations

103 ANS:
\[ \frac{4}{9} x^2 - \frac{4}{3} x + 1 \cdot \left( \frac{2}{3} x - 1 \right)^2 = \left( \frac{2}{3} x - 1 \right) \left( \frac{2}{3} x - 1 \right) = \frac{4}{9} x^2 - \frac{2}{3} x - \frac{2}{3} x + 1 = \frac{4}{9} x^2 - \frac{4}{3} x + 1 \]

PTS: 2  REF: 081034a2  STA: A2.N.3  TOP: Operations with Polynomials

104 ANS: 2  PTS: 2  REF: 011114a2  STA: A2.N.3
TOP: Operations with Polynomials

105 ANS:
\[ 6 y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \cdot \left( \frac{1}{2} y^2 - \frac{1}{3} y \right) \left( 12 y + \frac{3}{5} \right) = 6 y^3 + \frac{3}{10} y^2 - 4 y^2 - \frac{1}{5} y = 6 y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \]

PTS: 2  REF: 061128a2  STA: A2.N.3  TOP: Operations with Polynomials

106 ANS: 2
The binomials are conjugates, so use FL.

PTS: 2  REF: 011206a2  STA: A2.N.3  TOP: Operations with Polynomials

107 ANS: 1
The binomials are conjugates, so use FL.

PTS: 2  REF: 061201a2  STA: A2.N.3  TOP: Operations with Polynomials

108 ANS: 1  PTS: 2  REF: 011314a2  STA: A2.N.3
TOP: Operations with Polynomials

109 ANS: 3
\[ \frac{3^{-2}}{(-2)^{-3}} = \frac{\frac{1}{9}}{-\frac{1}{8}} = -\frac{8}{9} \]

PTS: 2  REF: 061003a2  STA: A2.N.1  TOP: Negative and Fractional Exponents

110 ANS: 3
\[ 6n^{-1} < 4n^{-1} \]. Flip sign when multiplying each side of the inequality by \( n \), since a negative number.
\[ \frac{6}{n} < \frac{4}{n} \]
\[ 6 > 4 \]

PTS: 2  REF: 061314a2  STA: A2.N.1  TOP: Negative and Fractional Exponents
111 \text{ ANS: } 2

\left( \frac{w^{-5}}{w^{-9}} \right)^{\frac{1}{2}} = \left( w^{4} \right)^{\frac{1}{2}} = w^{2}

PTS: 2 \quad \text{REF: 081011a2} \quad \text{STA: A2.A.8} \quad \text{TOP: Negative and Fractional Exponents}

112 \text{ ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: 011306a2} \quad \text{STA: A2.A.8}
\text{TOP: Negative and Fractional Exponents}

113 \text{ ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: 011402a2} \quad \text{STA: A2.A.8}
\text{TOP: Negative and Fractional Exponents}

114 \text{ ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: fall0914a2} \quad \text{STA: A2.A.9}
\text{TOP: Negative and Fractional Exponents}

115 \text{ ANS: } 2

\frac{x^{-1} - 1}{x - 1} = \frac{1 - x}{x} - 1 = \frac{x}{x - 1} = \frac{-x + 1}{x - 1} = \frac{-1}{x}

PTS: 2 \quad \text{REF: 081018a2} \quad \text{STA: A2.A.9} \quad \text{TOP: Negative Exponents}

116 \text{ ANS: }

\frac{12x^2}{y^9} \cdot \frac{3x^{-4}y^5}{(2x^{-3}y^{-7})^2} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^2}{y^9}

PTS: 2 \quad \text{REF: 061134a2} \quad \text{STA: A2.A.9} \quad \text{TOP: Negative Exponents}

117 \text{ ANS: } 2

\frac{x^{-1} + 1}{x + 1} = \frac{1}{x} + 1 = \frac{x + 1}{x + 1} = \frac{1}{x}

PTS: 2 \quad \text{REF: 011211a2} \quad \text{STA: A2.A.9} \quad \text{TOP: Negative Exponents}

118 \text{ ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: 061210a2} \quad \text{STA: A2.A.9}
\text{TOP: Negative Exponents}

119 \text{ ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: 061324a2} \quad \text{STA: A2.A.9}
\text{TOP: Negative Exponents}

120 \text{ ANS: }

\begin{array}{c}
\begin{array}{c}
12000 \times (0.865 + 19) \\
2298.648995
\end{array}
\end{array}

2,298.65.

PTS: 2 \quad \text{REF: fall0932a2} \quad \text{STA: A2.A.12} \quad \text{TOP: Evaluating Exponential Expressions}
121 ANS: 
\[ e^{3\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8 \]

PTS: 2  REF: 061131a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

122 ANS: 
\[ A = 750e^{(0.03)(8)} \approx 953 \]

PTS: 2  REF: 061229a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

123 ANS: 3
\[ 5000 \left( 1 + \frac{0.03}{4} \right)^{4 \cdot 5} = 5000(1.0075)^{20} \approx 5805.92 \]

PTS: 2  REF: 011410a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

124 ANS: 2
\[ 8^2 = 64 \]

PTS: 2  REF: fall0909a2  STA: A2.A.18  TOP: Evaluating Logarithmic Expressions

125 ANS: 4


126 ANS:

\[
\begin{align*}
\text{PTS: 2} & \quad \text{REF: 061031a2} & \quad \text{STA: A2.A.53} & \quad \text{TOP: Graphing Exponential Functions}
\end{align*}
\]
127 ANS:

![Graph](image)

\[ f^{-1}(x) = \log_4 x \]

PTS: 2 REF: fall0916a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

128 ANS: 2

PTS: 2 REF: 011234a2 STA: A2.A.53 TOP: Graphing Exponential Functions

129 ANS: 2

\[ 2 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3 z} \]

PTS: 2 REF: 011301a2 STA: A2.A.53 TOP: Graphing Exponential Functions

130 ANS: 1

PTS: 2 REF: 061211a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

131 ANS: 3

PTS: 2 REF: 011422a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

132 ANS: 1

\[ 2 \log x = \log 3a + \log 2a \]

\[ 2 \log x = \log 6a^2 \]

\[ \log x = \frac{\log 6}{2} + \frac{\log a^2}{2} \]

\[ \log x = \frac{1}{2} \log 6 + \frac{2 \log a}{2} \]

\[ \log x = \frac{1}{2} \log 6 + \log a \]

PTS: 2 REF: fall0916a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

133 ANS: 4

PTS: 2 REF: 061120a2 STA: A2.A.19 TOP: Properties of Logarithms

134 ANS: 2


135 ANS: 4

136 ANS: 2
\[ \log 9 - \log 20 \]
\[ \log 3^2 - \log (10 \cdot 2) \]
\[ 2 \log 3 - (\log 10 + \log 2) \]
\[ 2b - (1 + a) \]
\[ 2b - a - 1 \]

KEY: expressing logs algebraically

137 ANS: 3
\[ \log 4m^2 = \log 4 + \log m^2 = \log 4 + 2 \log m \]

KEY: splitting logs

138 ANS: 4
\[ 2 \log_4 (5x) = 3 \]
\[ \log_4 (5x) = \frac{3}{2} \]
\[ 5x = 4^{\frac{3}{2}} \]
\[ 5x = 8 \]
\[ x = \frac{8}{5} \]

PTS: 2 REF: fall0921a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced
ANS: 
\[ x = -\frac{1}{3}, -1 \]
\[ \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]
\[ \frac{x^3 + x - 2}{x} = (x + 3)^2 \]
\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]
\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]
\[ 0 = 6x^2 + 8x + 2 \]
\[ 0 = 3x^2 + 4x + 1 \]
\[ 0 = (3x + 1)(x + 1) \]
\[ x = -\frac{1}{3}, -1 \]

KEY: basic

140 ANS:
\[ \ln(T - T_0) = -kt + 4.718 \]
\[ \ln(150 - 68) = -k(3) + 4.718 \]
\[ \ln(68) = 3.678 \]

\[ 4.407 \approx -3k + 4.718 \]
\[ T - 68 \approx 39.6 \]
\[ k \approx 0.104 \]
\[ T \approx 108 \]

KEY: advanced

141 ANS: 3
\[ x = 5^4 = 625 \]

PTS: 2  REF: 061106a2  STA: A2.A.28  TOP: Logarithmic Equations
KEY: basic

142 ANS:
\[ 800. \ x = 4^{\frac{3}{5}} = 32. \ y = 125. \ \frac{3}{2} = 125 \]
\[ \frac{x}{y} = \frac{32}{125} = 800 \]
\[ y = 125 \left( \frac{2}{3} \right) = \frac{1}{25} \]

PTS: 4  REF: 011237a2  STA: A2.A.28  TOP: Logarithmic Equations
KEY: advanced
143 ANS:
\[(x + 4)^2 = 17x - 4\]
\[x^2 + 8x + 16 = 17x - 4\]
\[x^2 - 9x + 20 = 0\]
\[(x - 4)(x - 5) = 0\]
\[x = 4, 5\]

PTS: 4  REF: 011336a2  STA: A2.A.28  TOP: Logarithmic Equations  KEY: basic

144 ANS:
\[2x - 1 = \frac{4}{3}\]
\[2x - 1 = 81\]
\[2x = 82\]
\[x = 41\]

PTS: 2  REF: 061329a2  STA: A2.A.28  TOP: Logarithmic Equations  KEY: advanced

145 ANS:
\[\log_{(x + 3)}(2x + 3)(x + 5) = 2\]
\[-6\] is extraneous
\[(x + 3)^2 = (2x + 3)(x + 5)\]
\[x^2 + 6x + 9 = 2x^2 + 13x + 15\]
\[x^2 + 7x + 6 = 0\]
\[(x + 6)(x + 1) = 0\]
\[x = -1\]


146 ANS: 3
\[75000 = 25000e^{0.0475t}\]
\[3 = e^{0.0475t}\]
\[\ln 3 = \ln e^{0.0475t}\]
\[\frac{\ln 3}{0.0475} = \frac{0.0475 \cdot \ln e}{0.0475}\]
\[23.1 \approx t\]

PTS: 2  REF: 061117a2  STA: A2.A.6  TOP: Exponential Growth
147 ANS: 2

\[ 320 = 10(2)^{\frac{t}{60}} \]

\[ 32 = (2)^{\frac{t}{60}} \]

\[ \log_{32} = \log(2)^{\frac{t}{60}} \]

\[ \log_{32} = \frac{t \log 2}{60} \]

\[ \frac{60 \log_{32}}{\log 2} = t \]

\[ 300 = t \]

PTS: 2 REF: 011205a2 STA: A2.A.6 TOP: Exponential Growth

148 ANS:

\[ 30700 = 50e^{3t} \]

\[ 614 = e^{3t} \]

\[ \ln 614 = \ln e^{3t} \]

\[ \ln 614 = 3t \ln e \]

\[ \ln 614 = 3t \]

\[ 2.14 \approx t \]

PTS: 2 REF: 011333a2 STA: A2.A.6 TOP: Exponential Growth

149 ANS: 3

\[ 1000 = 500e^{0.05t} \]

\[ 2 = e^{0.05t} \]

\[ \ln 2 = \ln e^{0.05t} \]

\[ \ln 2 = 0.05t \cdot \ln e \]

\[ \ln 2 \times 0.05 = 0.05t \cdot \ln e \]

\[ 13.9 \approx t \]

PTS: 2 REF: 061313a2 STA: A2.A.6 TOP: Exponential Growth
150 ANS: 3
\[4^{2x + 4} = 2^{-6}, \quad 2x^2 + 8x = -6\]
\[(2^2)^{2x + 4} = 2^{-6}, \quad 2x^2 + 8x + 6 = 0\]
\[22x^2 + 8x = 2^{-6}, \quad (x + 3)(x + 1) = 0\]
\[x = -3, \quad x = -1\]

PTS: 2  REF: 061015a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base shown

151 ANS: 4
\[9^{3x + 1} = 27^{x + 2}\]
\[(3^2)^{3x + 1} = (3^3)^{x + 2}\]
\[3^{6x + 2} = 3^{3x + 6}\]
\[6x + 2 = 3x + 6\]
\[3x = 4\]
\[x = \frac{4}{3}\]

PTS: 2  REF: 081008a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base not shown

152 ANS:
\[16^{2x + 3} = 64^{x + 2}\]
\[(4^2)^{2x + 3} = (4^3)^{x + 2}\]
\[4x + 6 = 3x + 6\]
\[x = 0\]

PTS: 2  REF: 011128a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base not shown

153 ANS: 2
\[4^{2x + 5} = 8^{3x}\]
\[\left(2^2\right)^{2x + 5} = \left(2^3\right)^{3x}\]
\[2^{4x + 10} = 2^{9x}\]
\[4x + 10 = 9x\]
\[10 = 5x\]
\[2 = x\]

PTS: 2  REF: 061105a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base not shown
154 ANS:

\[ 81^{x^2 + 2x^2} = 27^{\frac{5x}{3}} \]

\[ \left( 3^4 \right)^{x^2 + 2x^2} = \left( 3^3 \right)^{\frac{5x}{3}} \]

\[ 3^{4x^2 + 8x^2} = 3^{\frac{5x}{3}} \]

\[ 4x^3 + 8x^2 - 5x = 0 \]

\[ x(4x^2 + 8x - 5) = 0 \]

\[ x(2x - 1)(2x + 5) = 0 \]

\[ x = 0, \quad \frac{1}{2}, \quad -\frac{5}{2} \]

PTS: 6   REF: 061239a2   STA: A2.A.27   TOP: Exponential Equations

KEY: common base not shown

155 ANS: 4

\[ 8^{3k + 4} = 4^{2k - 4} \]

\[ (2^3)^{3k + 4} = (2^2)^{2k - 4} \]

\[ 2^{9k + 12} = 2^{4k - 2} \]

\[ 9k + 12 = 4k - 2 \]

\[ 5k = -14 \]

\[ k = -\frac{14}{5} \]

PTS: 2   REF: 011309a2   STA: A2.A.27   TOP: Exponential Equations

KEY: common base not shown

156 ANS: 1

\[ \binom{5}{3}(3x)^3(-2)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2 \]

PTS: 2   REF: fall0919a2   STA: A2.A.36   TOP: Binomial Expansions

157 ANS:

\[ 32x^3 - 80x^4 + 80x^3 - 40x^2 + 10x - 1. \]

\[ \binom{6}{0}(2x)^5(-1)^0 = 32x^5. \]

\[ \binom{6}{1}(2x)^4(-1)^1 = -80x^4. \]

\[ \binom{6}{2}(2x)^3(-1)^2 = 80x^3. \]

\[ \binom{6}{3}(2x)^2(-1)^3 = -40x^2. \]

\[ \binom{6}{4}(2x)^1(-1)^4 = 10x. \]

\[ \binom{6}{5}(2x)^0(-1)^5 = -1 \]

PTS: 4   REF: 011136a2   STA: A2.A.36   TOP: Binomial Expansions

158 ANS: 1

\[ \binom{6}{3}a^6(-4b)^3 = -5376a^6b^3 \]

PTS: 2   REF: 061126a2   STA: A2.A.36   TOP: Binomial Expansions
159 ANS: 3
\[ \binom{3}{2} (2x^4)^1 (-y)^2 = 6x^4y^2 \]

PTS: 2 REF: 011215a2 STA: A2.A.36 TOP: Binomial Expansions

160 ANS: 3
\[ \binom{6}{3} \left( \frac{x}{2} \right)^3 (−2y)^3 = 20 \cdot \frac{x^3}{8} \cdot (−8y^3) = −20x^3y^3 \]

PTS: 2 REF: 061215a2 STA: A2.A.36 TOP: Binomial Expansions

161 ANS: 3
\[ \binom{8}{3} \cdot x^{8−3} \cdot (−2)^3 = 56x^5 \cdot (−8) = −448x^5 \]

PTS: 2 REF: 011308a2 STA: A2.A.36 TOP: Binomial Expansions

162 ANS:
\[ \pm \frac{3}{2}, -\frac{1}{2} \]
\[ 8x^3 + 4x^2 - 18x - 9 = 0 \]
\[ 4x^2(2x + 1) - 9(2x + 1) = 0 \]
\[ (4x^2 - 9)(2x + 1) = 0 \]
\[ 4x^2 - 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x - 3) = 0 \quad x = -\frac{1}{2} \]
\[ x = ± \frac{3}{2} \]

PTS: 4 REF: fall0937a2 STA: A2.A.26 TOP: Solving Polynomial Equations

163 ANS: 2
\[ x^3 + x^2 - 2x = 0 \]
\[ x(x^2 + x - 2) = 0 \]
\[ x(x + 2)(x - 1) = 0 \]
\[ x = 0, -2, 1 \]

PTS: 2 REF: 011103a2 STA: A2.A.26 TOP: Solving Polynomial Equations

164 ANS: 3
\[ 3x^3 - 48x = 0 \]
\[ 3x(x^2 - 16) = 0 \]
\[ 3x(x^2 + 4)(x^2 - 4) = 0 \]
\[ 3x(x^2 + 4)(x + 2)(x - 2) = 0 \]

PTS: 2 REF: 011216a2 STA: A2.A.26 TOP: Solving Polynomial Equations
165 ANS:

\[ x^4 + 4x^3 + 4x^2 + 16x = 0 \]
\[ x(x^3 + 4x^2 + 4x + 16) = 0 \]
\[ x(x^2(x + 4) + 4(x + 4)) = 0 \]
\[ x(x^2 + 4)(x + 4) = 0 \]

\[ x = 0, \pm 2i, -4 \]


166 ANS: 4 PTS: 2 REF: 061005a2 STA: A2.A.50
TOP: Solving Polynomial Equations

167 ANS: 2

The roots are \(-1, 2, 3\).

PTS: 2 REF: 081023a2 STA: A2.A.50 TOP: Solving Polynomial Equations

168 ANS: 4

\[ (3 + \sqrt{5})(3 - \sqrt{5}) = 9 - \sqrt{25} = 4 \]

PTS: 2 REF: 081001a2 STA: A2.N.4 TOP: Operations with Irrational Expressions
KEY: without variables | index = 2

170 ANS:

\[ -\frac{a^2b^3}{4} \]

PTS: 2 REF: 011231a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

171 ANS: 3

\[ \sqrt[3]{4^3a^{15}} = 4a^5\sqrt[3]{a} \]

PTS: 2 REF: 061204a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

172 ANS:

\[ 5\sqrt{3x^3} - 2\sqrt{27x^3} = 5\sqrt{x^2\sqrt{3x} - 2\sqrt{9x^2\sqrt{3x}}} = 5x\sqrt{3} - 6x\sqrt{3} = -x\sqrt{3} \]

PTS: 2 REF: 061032a2 STA: A2.N.2 TOP: Operations with Radicals
\[ 3\sqrt{6a^4b^2} + \sqrt[3]{27 \cdot 6a^4b^2} \]
\[ a^3\sqrt{6ab^2} + 3a\sqrt[3]{6ab^2} \]
\[ 4a^3\sqrt{6ab^2} \]

PTS: 2  REF: 011319a2  STA: A2.N.2  TOP: Operations with Radicals

\[ \left( \frac{3}{27x^2} \right) \left( \frac{3}{16x^4} \right) = \frac{3\cdot 3^3 \cdot 2^4 \cdot x^6}{27 \cdot 16x^8} = \frac{3 \cdot 2 \cdot x^2 \sqrt{2}}{6x^2 \sqrt{2}} = \frac{3}{2} \]

PTS: 2  REF: 011421a2  STA: A2.N.2  TOP: Operations with Radicals

\[ 4ab\sqrt{2b} - 3a\sqrt{9b^2 \cdot 2b} + 7ab\sqrt{6b} = 4ab\sqrt{2b} - 9ab\sqrt{2b} + 7ab\sqrt{6b} = -5ab\sqrt{2b} + 7ab\sqrt{6b} \]

PTS: 2  REF: fall0918a2  STA: A2.A.14  TOP: Operations with Radicals

KEY: with variables | index = 2

\[ \sqrt[3]{108x^5y^8} \]
\[ \sqrt[6]{xy^5} = \sqrt[3]{18x^2y^2} = 3x^2y\sqrt{2y} \]


KEY: with variables | index = 2

\[ \frac{5(3 + \sqrt{2})}{7} \cdot \frac{5}{3 - \sqrt{2}} \cdot \frac{3 + \sqrt{2}}{3 + \sqrt{2}} = \frac{5(3 + \sqrt{2})}{9 - 2} = \frac{5(3 + \sqrt{2})}{7} \]

PTS: 2  REF: fall0928a2  STA: A2.N.5  TOP: Rationalizing Denominators

\[ \sqrt[3]{3 + 5} \cdot \frac{\sqrt[3]{3 + 5}}{\sqrt[3]{3 - 5}} = \frac{3 + 5\sqrt[3]{3 + 5}}{3 - 25} = \frac{28 + 10\sqrt[3]{3}}{-22} = -\frac{14 + 5\sqrt[3]{3}}{11} \]

PTS: 2  REF: 061012a2  STA: A2.N.5  TOP: Rationalizing Denominators

\[ \frac{4}{5 - \sqrt{13}} \cdot \frac{5 + \sqrt{13}}{5 + \sqrt{13}} = \frac{4(5 + \sqrt{13})}{25 - 13} = \frac{5 + \sqrt{13}}{3} \]

PTS: 2  REF: 061116a2  STA: A2.N.5  TOP: Rationalizing Denominators
\[
\frac{1}{7 - \sqrt{11}} \cdot \frac{7 + \sqrt{11}}{7 + \sqrt{11}} = \frac{7 + \sqrt{11}}{49 - 11} = \frac{7 + \sqrt{11}}{38}
\]

**PTS: 2**  
**REF: 011404a2**  
**STA: A2.N.5**  
**TOP: Rationalizing Denominators**

181 ANS: 3

\[
\frac{3}{\sqrt{3a^2b}} = \frac{3}{a\sqrt{3b}} \cdot \frac{\sqrt{3b}}{\sqrt{3b}} = \frac{3\sqrt{3b}}{3ab} = \frac{\sqrt{3b}}{ab}
\]

**PTS: 2**  
**REF: 081019a2**  
**STA: A2.A.15**  
**TOP: Rationalizing Denominators**  
**KEY: index = 2**

182 ANS: 4

\[
\frac{2x + 4}{\sqrt{x + 2}} \cdot \frac{\sqrt{x + 2}}{\sqrt{x + 2}} = \frac{2(x + 2)\sqrt{x + 2}}{x + 2} = 2\sqrt{x + 2}
\]

**PTS: 2**  
**REF: 011122a2**  
**STA: A2.A.15**  
**TOP: Rationalizing Denominators**  
**KEY: index = 2**

183 ANS: 4

\[
\frac{x}{x - \sqrt{x}} \times \frac{x + \sqrt{x}}{x + \sqrt{x}} = \frac{x^2 + x\sqrt{x}}{x^2 - x} = \frac{x(x + \sqrt{x})}{x(x - 1)} = \frac{x + \sqrt{x}}{x - 1}
\]

**PTS: 2**  
**REF: 061325a2**  
**STA: A2.A.15**  
**TOP: Rationalizing Denominators**  
**KEY: index = 2**

184 ANS: 1

**PTS: 2**  
**REF: 061018a2**  
**STA: A2.A.22**  
**TOP: Solving Radicals**  
**KEY: extraneous solutions**

185 ANS: 3

\[3x + 16 = (x + 2)^2 \quad -4\] is an extraneous solution.

\[3x + 16 = x^2 + 4x + 4\]

\[0 = x^2 + x - 12\]

\[0 = (x + 4)(x - 3)\]

\[x = -4 \quad x = 3\]

**PTS: 2**  
**REF: 061121a2**  
**STA: A2.A.22**  
**TOP: Solving Radicals**  
**KEY: extraneous solutions**
186 ANS:
7. \(4 - \sqrt{2x - 5} = 1\)
   \[-\sqrt{2x - 5} = -3\]
   \[2x - 5 = 9\]
   \[2x = 14\]
   \[x = 7\]

PTS: 2    REF: 011229a2    STA: A2.A.22    TOP: Solving Radicals
KEY: basic

187 ANS: 1
5x + 29 = (x + 3)^2  \((-5) + 3\) shows an extraneous solution.
5x + 29 = x^2 + 6x + 9
0 = x^2 + x - 20
0 = (x + 5)(x - 4)
\[x = -5, 4\]

PTS: 2    REF: 061213a2    STA: A2.A.22    TOP: Solving Radicals
KEY: extraneous solutions

188 ANS:
\[\sqrt{x^2 + x - 1} = -4x + 3\]
\[\frac{-4}{3} + 3 \geq 0\]
\[x^2 + x - 1 = 16x^2 - 24x + 9\]
\[0 = 15x^2 - 25x + 10\]
\[\frac{1}{3} \geq 0\]
\[0 = 3x^2 - 5x + 2\]
\[\frac{-4(1) + 3 < 0}{-4(1)}\]
\[0 = (3x - 2)(x - 1)\]
\[1\text{ is extraneous}\]
\[x = \frac{2}{3}, x \neq 1\]

PTS: 6    REF: 011339a2    STA: A2.A.22    TOP: Solving Radicals
KEY: extraneous solutions

189 ANS: 2    PTS: 2    REF: 061011a2    STA: A2.A.10    TOP: Fractional Exponents as Radicals

190 ANS: 4
\[x^{-\frac{2}{5}} = \frac{\frac{1}{2}}{\frac{1}{5}} = \frac{1}{\sqrt[5]{x^2}}\]

PTS: 2    REF: 011118a2    STA: A2.A.10    TOP: Fractional Exponents as Radicals
\[\sqrt[4]{16x^2 y^7} = 16^{\frac{1}{4}} x^{\frac{2}{4}} y^{\frac{7}{4}} = 2x^{\frac{1}{2}} y^{\frac{7}{4}}\]

PTS: 2  
REF: 061107a2  
STA: A2.A.11  
TOP: Radicals as Fractional Exponents

\[\sqrt{-300} = \sqrt{100} \sqrt{-1} \sqrt{3}\]

PTS: 2  
REF: 061006a2  
STA: A2.N.6  
TOP: Square Roots of Negative Numbers

\[2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i\]

PTS: 2  
REF: 081004a2  
STA: A2.N.7  
TOP: Imaginary Numbers

\[i^{13} + i^{18} + i^{31} + n = 0\]
\[i + (-1) - i + n = 0\]
\[-1 + n = 0\]
\[n = 1\]

PTS: 2  
REF: 061228a2  
STA: A2.N.7  
TOP: Imaginary Numbers

\[4xi + 5yi^8 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi\]

PTS: 2  
REF: 011433a2  
STA: A2.N.7  
TOP: Imaginary Numbers

\[2(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i\]

PTS: 2  
REF: fall0901a2  
STA: A2.N.9  
TOP: Multiplication and Division of Complex Numbers

\[(x + i)^2 - (x - i)^2 = x^2 + 2xi + i^2 - (x^2 - 2xi + i^2) = 4xi\]

PTS: 2  
REF: 011327a2  
STA: A2.N.9  
TOP: Multiplication and Division of Complex Numbers
\[
(3i)(2i)^2(m + i)
\]
\[
(3i)(4i^2)(m + i)
\]
\[
(3i)(-4)(m + i)
\]
\[
(-12i)(m + i)
\]
\[
-12mi - 12i^2
\]
\[
-12mi + 12
\]

PTS: 2  REF: 061319a2  STA: A2.N.9  TOP: Multiplication and Division of Complex Numbers

\[
\frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2(x - 3) + 6(x - 3)}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}
\]
\[
\frac{(x^2 + 6)(x - 3)}{x(x - 4)} \cdot \frac{2(x - 2)}{x^3(x - 3)} \cdot \frac{(4 + x)(4 - x)}{(x + 4)(x - 2)}
\]
\[
\frac{-2(x^2 + 6)}{x^4}
\]

PTS: 6  REF: 011239a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: division

\[
\frac{-(x^2 - 4)}{(x + 4)(x + 3)} \times \frac{x + 3}{2(x - 2)} = \frac{-(x + 2)(x - 2)}{x + 4} \times \frac{1}{2(x - 2)} = \frac{-(x + 2)}{2(x + 4)}
\]

PTS: 4  REF: 061236a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: division

\[
\frac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x) = \frac{(x + 11)(x - 2)}{(x + 11)(x - 11)} \cdot \frac{-1}{x - 2} = \frac{-1}{x - 11}
\]

PTS: 2  REF: 011423a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: Division

\[
\frac{3y}{2y - 6} + \frac{9}{6 - 2y} = \frac{3y}{2y - 6} - \frac{9}{2y - 6} = \frac{3y - 9}{2y - 6} = \frac{3(y - 3)}{2(y - 3)} = \frac{3}{2}
\]

208 ANS:  
no solution. \[ \frac{4x}{x-3} = 2 + \frac{12}{x-3} \]
\[ \frac{4x - 12}{x - 3} = 2 \]
\[ \frac{4(x - 3)}{x - 3} = 2 \]
\[ 4 \neq 2 \]

PTS: 2 REF: fall0930a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

209 ANS:  
\[ \frac{1}{3} \left( \frac{1}{x+3} - \frac{2}{3-x} \right) = \frac{4}{x^2 - 9} \]
\[ \frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2 - 9} \]
\[ \frac{x - 3 + 2(x + 3)}{(x + 3)(x - 3)} = \frac{4}{(x + 3)(x - 3)} \]
\[ x - 3 + 2x + 6 = 4 \]
\[ 3x = 1 \]
\[ x = \frac{1}{3} \]

PTS: 4 REF: 081036a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

210 ANS:  
\[ \frac{13}{x} = 10 - x \]  
\[ x = \frac{10 \pm \sqrt{100 - 4(1)(13)}}{2(1)} = \frac{10 \pm \sqrt{100 - 48}}{2} = \frac{10 \pm \sqrt{52}}{2} = \frac{10 \pm 2\sqrt{13}}{2} = 5 \pm \sqrt{13} \]
\[ 13 = 10x - x^2 \]
\[ x^2 - 10x + 13 = 0 \]

PTS: 4 REF: 061336a2 STA: A2.A.23 TOP: Solving Rationals
KEY: irrational and complex solutions
\[ \frac{x+16}{x-2} - \frac{7(x-2)}{x-2} \leq 0 \quad \text{Check points such that } x < 2, 2 < x < 5, \text{ and } x > 5. \]

If \( x = 1, \)
\[ \frac{-6x+30}{x-2} \leq 0 \quad \text{ } \Rightarrow \quad \frac{-6 \times 1 + 30}{1-2} = \frac{24}{1} = -24, \text{ which is less than 0.} \]

If \( x = 3, \)
\[ \frac{-6(3)+30}{3-2} = \frac{12}{1} = 12, \text{ which is greater than 0.} \]

If \( x = 6, \)
\[ \frac{-6(6)+30}{6-2} = \frac{-6}{2} = -\frac{3}{2}, \text{ which is less than 0.} \]

PTS: 2

Ref: 011424a2

STA: A2.A.23

TOP: Rational Inequalities

212 ANS: 2

\[ \frac{x}{4} - \frac{1}{x} = \frac{x^2 - 4}{4x} = \frac{(x+2)(x-2)}{4x} \times \frac{8x}{2(x+2)} = x - 2 \]

PTS: 2

Ref: fall0920a2

STA: A2.A.17

TOP: Complex Fractions

213 ANS:

\[ \frac{1}{d} + \frac{3}{2d} = \frac{d}{2d} - \frac{8}{2d} \times \frac{2d + 3d}{2d^2} = \frac{d - 8}{5d} \]

PTS: 2

Ref: 061035a2

STA: A2.A.17

TOP: Complex Fractions

214 ANS: 2

\[ \frac{1}{x} - \frac{4}{x} \times \frac{x^2}{1 - \frac{2}{x} - \frac{8}{x^2}} = \frac{x^2 - 4x}{x^2 - 2x - 8} = \frac{x(x - 4)}{(x - 4)(x + 2)} = \frac{x}{x + 2} \]

PTS: 2

Ref: 061305a2

STA: A2.A.17

TOP: Complex Fractions

215 ANS: 3

\[ \frac{a+b}{c} = \frac{ac+b}{cd-b} \]

PTS: 2

Ref: 011405a2

STA: A2.A.17

TOP: Complex Fractions

216 ANS: 3

\[ 12 \cdot 6 = 9w \]
\[ 8 = w \]

PTS: 2

Ref: 011130a2

STA: A2.A.5

TOP: Inverse Variation
217 ANS: 1
\[10 \cdot \frac{3}{2} = \frac{3}{5} p\]
\[15 = \frac{3}{5} p\]
\[25 = p\]

PTS: 2 REF: 011226a2 STA: A2.A.5 TOP: Inverse Variation

218 ANS: 1
\[20(-2) = x(-2x + 2)\]
\[-40 = -2x^2 + 2x\]
\[2x^2 - 2x - 40 = 0\]
\[x^2 - x - 20 = 0\]
\[(x + 4)(x - 5) = 0\]
\[x = -4, 5\]

PTS: 2 REF: 011321a2 STA: A2.A.5 TOP: Inverse Variation

219 ANS: 2
\[2^2 \cdot 3 = 12 ; \quad 6^2 d = 12\]
\[4^2 \cdot \frac{3}{4} = 12 \quad 36d = 12\]
\[d = \frac{1}{3}\]

PTS: 2 REF: 061310a2 STA: A2.A.5 TOP: Inverse Variation

220 ANS: 3
\[20 \cdot 2 = -5t\]
\[-8 = t\]

PTS: 2 REF: 011412a2 STA: A2.A.5 TOP: Inverse Variation

221 ANS: 4
\[y - 2\sin \theta = 3\]
\[y = 2\sin \theta + 3\]
\[f(\theta) = 2\sin \theta + 3\]

PTS: 2 REF: fall0927a2 STA: A2.A.40 TOP: Functional Notation

222 ANS: 2
\[f(10) = \frac{-10}{(-10)^2 - 16} = \frac{-10}{84} = -\frac{5}{42}\]

PTS: 2 REF: 061102a2 STA: A2.A.41 TOP: Functional Notation
\[ g(10) = \left( a(10) \sqrt{1 - x} \right)^2 = 100a^2(-9) = -900a^2 \]

(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

(1) and (4) fail the horizontal line test and are not one-to-one. Not every element of the range corresponds to only one element of the domain. (2) fails the vertical line test and is not a function. Not every element of the domain corresponds to only one element of the range.
242 ANS: 1   PTS: 2   REF: 011313a2   STA: A2.A.39
TOP: Domain and Range
KEY: real domain

243 ANS: 1   PTS: 2   REF: 011416a2   STA: A2.A.39
TOP: Domain and Range
KEY: real domain

244 ANS: 2   PTS: 2   REF: 081003a2   STA: A2.A.51
TOP: Domain and Range

245 ANS:
D: \(-5 \leq x \leq 8\).  R: \(-3 \leq y \leq 2\)

PTS: 2   REF: 011132a2   STA: A2.A.51   TOP: Domain and Range

246 ANS: 1   PTS: 2   REF: 061202a2   STA: A2.A.51
TOP: Domain and Range
Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic
Answer Section

247 ANS: 3 PTS: 2 REF: 061308ge STA: A2.A.51 TOP: Domain and Range

248 ANS: 3

\[ f(4) = \frac{1}{2}(4) - 3 = -1 \quad g(-1) = 2(-1) + 5 = 3 \]

PTS: 2 REF: fall0902a2 STA: A2.A.42 TOP: Compositions of Functions

249 ANS: 2

\[ 6(x^2 - 5) = 6x^2 - 30 \]

PTS: 2 REF: 011109a2 STA: A2.A.42 TOP: Compositions of Functions

250 ANS: 7.  

\[ f(-3) = (-3)^2 - 6 = 3 \quad g(x) = 2^3 - 1 = 7 \]

PTS: 2 REF: 061135a2 STA: A2.A.42 TOP: Compositions of Functions

251 ANS: 4

\[ g \left( \frac{1}{2} \right) = \frac{1}{\frac{1}{2}} = 2 \quad f(2) = 4(2) - 2^2 = 4 \]

PTS: 2 REF: 011204a2 STA: A2.A.42 TOP: Compositions of Functions

252 ANS: 2 PTS: 2 REF: 061216a2 STA: A2.A.42 TOP: Compositions of Functions

253 ANS: 3

\[ h(-8) = \frac{1}{2}(-8) - 2 = -4 - 2 = -6 \quad g(-6) = \frac{1}{2}(-6) + 8 = -3 + 8 = 5 \]

PTS: 2 REF: 011403a2 STA: A2.A.42 TOP: Compositions of Functions

254 ANS: 3 PTS: 2 REF: 081027a2 STA: A2.A.44 TOP: Inverse of Functions

1
255 ANS:
\[ y = x^2 - 6. \ f^{-1}(x) \text{ is not a function.} \]
\[ x = y^2 - 6 \]
\[ x + 6 = y^2 \]
\[ \pm \sqrt{x + 6} = y \]

PTS: 2 REF: 061132a2 STA: A2.A.44 TOP: Inverse of Functions KEY: equations

256 ANS: 2 PTS: 2 REF: fall0926a2 STA: A2.A.46 TOP: Transformations with Functions and Relations

257 ANS: 1 PTS: 2 REF: 081022a2 STA: A2.A.46 TOP: Transformations with Functions and Relations

258 ANS: 4 PTS: 2 REF: 061026a2 STA: A2.A.29 TOP: Sequences

259 ANS: 1 common difference is 2. \( b_n = x + 2n \)
\[ 10 = x + 2(1) \]
\[ 8 = x \]

PTS: 2 REF: 081014a2 STA: A2.A.29 TOP: Sequences

260 ANS: 4 \[ \frac{10}{4} = 2.5 \]

PTS: 2 REF: 011217a2 STA: A2.A.29 TOP: Sequences

261 ANS:
\[ \frac{31 - 19}{7 - 4} = \frac{12}{3} = 4 \ x + (4 - 1)4 = 19 \ a_n = 7 + (n - 1)4 \]
\[ x + 12 = 19 \]
\[ x = 7 \]

PTS: 2 REF: 011434a2 STA: A2.A.29 TOP: Sequences

262 ANS: 3 PTS: 2 REF: 061001a2 STA: A2.A.30 TOP: Sequences

263 ANS: 3 PTS: 2 REF: 011110a2 STA: A2.A.30 TOP: Sequences

264 ANS: 1
\[ (4a + 4) - (2a + 1) = 2a + 3 \]

PTS: 2 REF: 011401a2 STA: A2.A.30 TOP: Sequences
265 ANS: 3
\[27r^{4-1} = 64\]
\[r^3 = \frac{64}{27}\]
\[r = \frac{4}{3}\]

PTS: 2 REF: 081025a2 STA: A2.A.31 TOP: Sequences

266 ANS: 3
\[\frac{4}{2} = -2\]

PTS: 2 REF: 011304a2 STA: A2.A.31 TOP: Sequences

267 ANS: 2
\[-\frac{3}{32}a^3b^4\]
\[= \frac{6b}{16a^5b^3} = \frac{6b}{a^2}\]

PTS: 2 REF: 061326a2 STA: A2.A.31 TOP: Sequences

268 ANS: 3
\[a_n = 5(-2)^{n-1}\]
\[a_{15} = 5(-2)^{15-1} = 81,920\]

PTS: 2 REF: 011105a2 STA: A2.A.32 TOP: Sequences

269 ANS: 1
\[a_n = -\sqrt{5}(-\sqrt{2})^{n-1}\]
\[a_{15} = -\sqrt{5}(-\sqrt{2})^{15-1} = -\sqrt{5}(-\sqrt{2})^{14} = -\sqrt{5} \cdot 2^7 = -128\sqrt{5}\]

PTS: 2 REF: 061109a2 STA: A2.A.32 TOP: Sequences

270 ANS:
\[-3, -5, -8, -12\]

PTS: 2 REF: fall0934a2 STA: A2.A.33 TOP: Recursive Sequences

271 ANS:
\[a_1 = 3, \ a_2 = 2(3) - 1 = 5, \ a_3 = 2(5) - 1 = 9.\]

PTS: 2 REF: 061233a2 STA: A2.A.33 TOP: Recursive Sequences
ANS: 3

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<th>0</th>
<th>1</th>
<th>2</th>
<th>$\Sigma$</th>
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<tbody>
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<td>$n^2 + 2^n$</td>
<td>$0^2 + 2^0 = 1$</td>
<td>$1^2 + 2^2 = 3$</td>
<td>$2^2 + 2^2 = 8$</td>
<td>12</td>
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</tbody>
</table>

$2 \times 12 = 24$

PTS: 2  REF: fall0911a2  STA: A2.N.10  TOP: Sigma Notation
KEY: basic

ANS:

$230. \ 10 + (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230$

PTS: 2  REF: 011131a2  STA: A2.N.10  TOP: Sigma Notation
KEY: basic

ANS: 1

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<th>4</th>
<th>5</th>
<th>$\Sigma$</th>
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<tbody>
<tr>
<td>$-r^2 + r$</td>
<td>$-3^2 + 3 = -6$</td>
<td>$-4^2 + 4 = -12$</td>
<td>$-5^2 + 5 = -20$</td>
<td>$-38$</td>
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PTS: 2  REF: 061118a2  STA: A2.N.10  TOP: Sigma Notation
KEY: basic

ANS: $\sum_{n=1}^{3} (-x^n + x)$

$-104.$

PTS: 2  REF: 011230a2  STA: A2.N.10  TOP: Sigma Notation
KEY: basic

ANS: 4

$4 + 3(2 - x) + 3(3 - x) + 3(4 - x) + 3(5 - x) + 4 + 6 - 3x + 9 - 3x + 12 - 3x + 15 - 3x$

$46 - 12x$

PTS: 2  REF: 061315a2  STA: A2.N.10  TOP: Sigma Notation
KEY: advanced

ANS: 4

$(a - 1)^2 + (a - 2)^2 + (a - 3)^2 + (a - 4)^2$

$(a^2 - 2a + 1) + (a^2 - 4a + 4) + (a^2 - 6a + 9) + (a^2 - 8a + 16)$

$4a^2 - 20a + 30$

PTS: 2  REF: 011414a2  STA: A2.N.10  TOP: Sigma Notation
KEY: advanced

ANS: 1  PTS: 2  REF: 061025a2  STA: A2.A.34  TOP: Sigma Notation
\[ \sum_{n=1}^{15} 7n \]

**PTS:** 2  
**REF:** 081029a2  
**STA:** A2.A.34  
**TOP:** Sigma Notation

**ANS:** 2

**TOP:** Sigma Notation

**ANS:** 4

\[ S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{21}{2} [2(18) + (21 - 1)2] = 798 \]

**PTS:** 2  
**REF:** 061103a2  
**STA:** A2.A.35  
**TOP:** Series  
**KEY:** arithmetic

**ANS:** 3

\[ S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{19}{2} [2(3) + (19 - 1)7] = 1254 \]

**PTS:** 2  
**REF:** 011202a2  
**STA:** A2.A.35  
**TOP:** Summations  
**KEY:** arithmetic

**ANS:**

\[ a_n = 9n - 4 \]

\[ S_n = \frac{20(5 + 176)}{2} = 1810 \]

\[ a_1 = 9(1) - 4 = 5 \]

\[ a_{20} = 9(20) - 4 = 176 \]

**PTS:** 2  
**REF:** 011328a2  
**STA:** A2.A.35  
**TOP:** Summations  
**KEY:** arithmetic

**ANS:** 3

\[ S_8 = \frac{3(1 - (-4)^8)}{1 - (-4)} = \frac{196,605}{5} = -39,321 \]

**PTS:** 2  
**REF:** 061304a2  
**STA:** A2.A.35  
**TOP:** Summations  
**KEY:** geometric
\begin{align*}
cos K &= \frac{5}{6} \\
K &= \cos^{-1} \frac{5}{6} \\
K &\approx 33^\circ33' 
\end{align*}

\text{PTS: 2} \quad \text{REF: 061023a2} \quad \text{STA: A2.A.55} \quad \text{TOP: Trigonometric Ratios}

\begin{align*}
\sqrt{12^2 - 6^2} &= \sqrt{108} = \sqrt{36 \cdot 3} = 6\sqrt{3} \cdot \cot J &= \frac{A}{O} = \frac{6}{6\sqrt{3}} = \frac{\sqrt{3}}{3} 
\end{align*}

\text{PTS: 2} \quad \text{REF: 011120a2} \quad \text{STA: A2.A.55} \quad \text{TOP: Trigonometric Ratios}

\begin{align*}
\sin S &= \frac{8}{17} \\
S &= \sin^{-1} \frac{8}{17} \\
S &\approx 28^\circ4'
\end{align*}

\text{PTS: 2} \quad \text{REF: 061311a2} \quad \text{STA: A2.A.55} \quad \text{TOP: Trigonometric Ratios}

\begin{align*}
2\pi \cdot \frac{5}{12} &= \frac{10\pi}{12} = \frac{5\pi}{6}
\end{align*}

\text{PTS: 2} \quad \text{REF: 061125a2} \quad \text{STA: A2.M.1} \quad \text{TOP: Radian Measure}
291 ANS: \[ 197^\circ 40' \times \frac{180}{\pi} \approx 197^\circ 40'. \]

PTS: 2 REF: fall0931a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

292 ANS: \[ 11 \pi \cdot \frac{180}{\pi} = 165 \]

PTS: 2 REF: 061002a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

293 ANS: \[ -420 \left( \frac{\pi}{180} \right) = -\frac{7\pi}{3} \]

PTS: 2 REF: 081002a2 STA: A2.M.2 TOP: Radian Measure
KEY: radians

294 ANS: \[ 2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ \]

PTS: 2 REF: 011129a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

295 ANS: \[ 2 \cdot \frac{180}{\pi} = \frac{360}{\pi} \]

PTS: 2 REF: 011220a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

296 ANS: \[ 216 \left( \frac{\pi}{180} \right) \approx 3.8 \]

PTS: 2 REF: 061232a2 STA: A2.M.2 TOP: Radian Measure
KEY: radians
297 ANS:

\[ 3 \times \frac{180}{\pi} \approx 171.89^\circ \approx 171^\circ 53'. \]

PTS: 2  
KEY: degrees  
REF: 011335a2  
STA: A2.M.2  
TOP: Radian Measure

298 ANS: 2

\[ \frac{8\pi}{5} \times \frac{180}{\pi} = 288 \]

PTS: 2  
KEY: degrees  
REF: 061302a2  
STA: A2.M.2  
TOP: Radian Measure

299 ANS: 1

\[ 5 \times \frac{180}{\pi} \approx 286 \]

PTS: 2  
KEY: degrees  
REF: 011427a2  
STA: A2.M.2  
TOP: Radian Measure

300 ANS:

PTS: 2  
REF: 061033a2  
STA: A2.A.60  
TOP: Unit Circle

301 ANS: 4  
PTS: 2  
REF: 081005a2  
STA: A2.A.60  
TOP: Unit Circle

302 ANS: 4  
PTS: 2  
REF: 061206a2  
STA: A2.A.60  
TOP: Unit Circle
303 ANS: 3
If \( \csc P > 0 \), \( \sin P > 0 \). If \( \cot P < 0 \) and \( \sin P > 0 \), \( \cos P < 0 \)

PTS: 2  REF: 061320a2  STA: A2.A.60  TOP: Finding the Terminal Side of an Angle

304 ANS: 4  PTS: 1  REF: 011312a2  STA: A2.A.56  TOP: Determining Trigonometric Functions  KEY: degrees, common angles

305 ANS:
\[
\frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} = \frac{\sqrt{6}}{4}
\]

PTS: 2  REF: 061331a2  STA: A2.A.56  TOP: Determining Trigonometric Functions  KEY: degrees, common angles

306 ANS:
\[
\frac{\sqrt{13}}{2} \cdot \sin \theta = \frac{\sqrt{x^2 + y^2}}{2} = \frac{2}{\sqrt{(-3)^2 + 2^2}} = \frac{2}{\sqrt{13}} \cdot \csc \theta = \frac{\sqrt{13}}{2}.
\]

PTS: 2  REF: fall0933a2  STA: A2.A.62  TOP: Determining Trigonometric Functions

307 ANS: 2

308 ANS: 1

PTS: 2  REF: 061115a2  STA: A2.A.66  TOP: Determining Trigonometric Functions

309 ANS: 4

PTS: 2  REF: 011203a2  STA: A2.A.66  TOP: Determining Trigonometric Functions

310 ANS: 3  PTS: 2  REF: 081007a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: basic

311 ANS: 3  PTS: 2  REF: 011104a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: unit circle
10

312 ANS: 1  PTS: 2  REF: 011112a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: advanced

313 ANS: 2

\[ \tan 30 = \frac{\sqrt{3}}{3} \]  \( \text{Arc cos} \left( \frac{\sqrt{3}}{k} \right) = 30 \)

\[ \frac{\sqrt{3}}{k} = \cos 30 \]

\[ k = 2 \]

PTS: 2  REF: 061323a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: advanced

314 ANS: 2

If \( \sin A = -\frac{7}{25} \), \( \cos A = \frac{24}{25} \), and \( \tan A = \frac{\sin A}{\cos A} = \frac{-7}{24} \)

PTS: 2  REF: 011413a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: advanced

315 ANS: 2

\( \cos(-305^\circ + 360^\circ) = \cos(55^\circ) \)

PTS: 2  REF: 061104a2  STA: A2.A.57  TOP: Reference Angles

316 ANS: 4

\( s = \theta r = 2 \cdot 4 = 8 \)

PTS: 2  REF: fall0922a2  STA: A2.A.61  TOP: Arc Length  KEY: arc length

317 ANS: 3

\[ s = \theta r = \frac{2\pi}{8} \cdot 6 = \frac{3\pi}{2} \]

PTS: 2  REF: 061212a2  STA: A2.A.61  TOP: Arc Length  KEY: arc length

318 ANS:

\( 83^\circ 50' \cdot \frac{\pi}{180} \approx 1.463 \text{ radians} \)  \( s = \theta r = 1.463 \cdot 12 \approx 17.6 \)

PTS: 2  REF: 011435a2  STA: A2.A.61  TOP: Arc Length  KEY: arc length

319 ANS: 3

Cofunctions tangent and cotangent are complementary

PTS: 2  REF: 061014a2  STA: A2.A.58  TOP: Cofunction Trigonometric Relationships
320 ANS: 3
\[ \frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta \]

PTS: 2 REF: 061123a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

321 ANS:
\[ \cos \theta \cdot \frac{1}{\cos \theta} - \cos^2 \theta = 1 - \cos^2 \theta = \sin^2 \theta \]

PTS: 2 REF: 061230a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

322 ANS:
\[ \begin{align*}
a + 15 + 2a &= 90 \\
3a + 15 &= 90 \\
3a &= 75 \\
a &= 25
\end{align*} \]

PTS: 2 REF: 011330a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

323 ANS:
\[ \cot x \sin x \sec x = \frac{\cos x}{\sin x} \cdot \frac{1}{\cos x} = \cos^2 x \]

PTS: 2 REF: 061334a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

324 ANS:
\[ \sec \theta \sin \theta \cot \theta = \frac{1}{\cos \theta} \cdot \sin \theta \cdot \frac{\cos \theta}{\sin \theta} = 1 \]

PTS: 2 REF: 011428a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

325 ANS:
\[ \frac{2\sqrt{3}}{3} \text{ if } \sin 60 = \frac{\sqrt{3}}{2}, \text{ then } \csc 60 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = 2 \frac{\sqrt{3}}{3} \]

PTS: 2 REF: 011235a2 STA: A2.A.59 TOP: Reciprocal Trigonometric Relationships

326 ANS:
\[ \frac{\sin^2 A}{\cos^2 A} + \frac{\cos^2 A}{\cos^2 A} = \frac{1}{\cos^2 A} = \sec^2 A \]
\[ \tan^2 A + 1 = \sec^2 A \]

PTS: 2 REF: 011135a2 STA: A2.A.67 TOP: Proving Trigonometric Identities

327 ANS: 2
PTS: 2 REF: 011208a2 STA: A2.A.67 TOP: Proving Trigonometric Identities

328 ANS: 3
PTS: 2 REF: fall0910a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities KEY: simplifying
\[
\begin{align*}
&\frac{23}{2} \cos^2 B + \sin^2 B = 1 \\
&\cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1 \\
&\cos^2 B + \frac{25}{41} = \frac{41}{41} \\
&\cos^2 B = \frac{16}{41} \\
&\cos B = \frac{4}{\sqrt{41}} \\
&\tan B = \frac{\sin B}{\cos B} = \frac{5}{4/4} = \frac{5}{4} \\
&\tan(A + B) = \frac{\frac{2}{3} + \frac{5}{4}}{1 - \left(\frac{2}{3}\right)\left(\frac{5}{4}\right)} = \frac{8 + \frac{15}{12}}{\frac{12}{12} - \frac{10}{12}} = \frac{23}{2} \\
&\cos(A - B) = \left(\frac{5}{13}\right)\left(-\frac{3}{5}\right) + \left(\frac{12}{13}\right)\left(\frac{4}{5}\right) = -\frac{15}{65} + \frac{48}{65} = \frac{33}{65} \\
&\sin(180 + x) = (\sin 180)(\cos x) + (\cos 180)(\sin x) = 0 + (-\sin x) = -\sin x \\
&\sin(\theta + 90) = \sin \theta \cdot \cos 90 + \cos \theta \cdot \sin 90 = \sin \theta \cdot (0) + \cos \theta \cdot (1) = \cos \theta
\end{align*}
\]
\[
\cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta
\]

PTS: 2  REF: 061024a2  STA: A2.A.77  TOP: Double Angle Identities
KEY: simplifying

\[
\left( \frac{2}{3} \right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A
\]
\[
\cos^2 A = \frac{5}{9} \quad = 2 \left( \frac{2}{3} \right) \left( \frac{\sqrt{5}}{3} \right)
\]
\[
\cos A = + \frac{\sqrt{5}}{3}, \text{ sin } A \text{ is acute.} \quad = \frac{4\sqrt{5}}{9}
\]

PTS: 2  REF: 011107a2  STA: A2.A.77  TOP: Double Angle Identities
KEY: evaluating

336  ANS: 1

If \( \sin x = 0.8 \), then \( \cos x = 0.6 \). \( \tan \frac{1}{2} x = \sqrt{\frac{1 - 0.6}{1 + 0.6}} = \sqrt{\frac{0.4}{1.6}} = 0.5 \).

PTS: 2  REF: 061220a2  STA: A2.A.77  TOP: Half Angle Identities

337  ANS: 4

\[
\cos 2A = 1 - 2 \sin^2 A = 1 - 2 \left( \frac{1}{3} \right)^2 = 1 - \frac{2}{9} = \frac{7}{9}
\]

PTS: 2  REF: 011311a2  STA: A2.A.77  TOP: Double Angle Identities
KEY: evaluating

338  ANS: 1

\[
\tan \theta - \sqrt{3} = 0
\]
\[
\tan \theta = \sqrt{3}
\]
\[
\theta = \tan^{-1} \sqrt{3}
\]
\[
\theta = 60, 240
\]

PTS: 2  REF: fall0903a2  STA: A2.A.68  TOP: Trigonometric Equations
KEY: basic
\begin{align*}
\sin 2\theta &= \sin \theta \\
\sin 2\theta - \sin \theta &= 0 \\
2\sin \theta \cos \theta - \sin \theta &= 0 \\
\sin \theta (2 \cos \theta - 1) &= 0 \\
\sin \theta &= 0 \quad 2 \cos \theta - 1 = 0 \\
\theta &= 0, 180 \cos \theta = \frac{1}{2} \\
\theta &= 60, 300
\end{align*}

\textbf{PTS: 4} \quad \textbf{REF: 061037a2} \quad \textbf{STA: A2.A.68} \quad \textbf{TOP: Trigonometric Equations}

\textbf{KEY: double angle identities}

\begin{align*}
2 \tan C - 3 &= 3 \tan C - 4 \\
1 &= \tan C \\
\tan^{-1} 1 &= C \\
C &= 45, 225
\end{align*}

\textbf{PTS: 2} \quad \textbf{REF: 081032a2} \quad \textbf{STA: A2.A.68} \quad \textbf{TOP: Trigonometric Equations}

\textbf{KEY: basic}

\begin{align*}
2 \cos \theta &= 1 \\
\cos \theta &= \frac{1}{2} \\
\theta &= \cos^{-1} \frac{1}{2} = 60, 300
\end{align*}

\textbf{PTS: 2} \quad \textbf{REF: 061203a2} \quad \textbf{STA: A2.A.68} \quad \textbf{TOP: Trigonometric Equations}

\textbf{KEY: basic}
\[-\sqrt{2} \sec x = 2\]
\[
\sec x = -\frac{2}{\sqrt{2}}
\]
\[
\cos x = -\frac{\sqrt{2}}{2}
\]
\[
x = 135, 225^\circ
\]

PTS: 2        REF: 011322a2        STA: A2.A.68        TOP: Trigonometric Equations

**KEY:** reciprocal functions

343 ANS:
5 \csc \theta = 8
\[
\csc \theta = \frac{8}{5}
\]
\[
\sin \theta = \frac{5}{8}
\]
\[
\theta \approx 141^\circ
\]

PTS: 2        REF: 061332a2        STA: A2.A.68        TOP: Trigonometric Equations

**KEY:** reciprocal functions

344 ANS:
2 \sin^2 x + 5 \sin x - 3 = 0
\[
(2 \sin x - 1)(\sin x + 3) = 0
\]
\[
\sin x = \frac{1}{2}
\]
\[
x = \frac{\pi}{6}, \frac{5\pi}{6}
\]

PTS: 4        REF: 011436a2        STA: A2.A.68        TOP: Trigonometric Equations

**KEY:** quadratics

345 ANS: 4
\[
\frac{2\pi}{b} = \frac{2\pi}{\frac{1}{3}} = 6\pi
\]

PTS: 2        REF: 061027a2        STA: A2.A.69        TOP: Properties of Graphs of Trigonometric Functions

**KEY:** period

346 ANS: 2
\[
\frac{2\pi}{b} = \frac{2\pi}{3}
\]

PTS: 2        REF: 061111a2        STA: A2.A.69        TOP: Properties of Graphs of Trigonometric Functions

**KEY:** period
$\frac{2\pi}{b} = 4\pi$

$b = \frac{1}{2}$

PTS: 2  REF: 011425a2  STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions  KEY: period

$\frac{2\pi}{b} = 30$

$b = \frac{\pi}{15}$

PTS: 2  REF: 011227a2  STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

$y = -3\sin 2x$. The period of the function is $\pi$, the amplitude is 3 and it is reflected over the $x$-axis.

PTS: 2  REF: 061235a2  STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

$\frac{2\pi}{b} = \frac{2\pi}{3\pi} = \frac{2}{3}$

PTS: 2  REF: 081026a2  STA: A2.A.70  TOP: Graphing Trigonometric Functions  KEY: recognize

ANS: 3
356 ANS: 1

\[
K = \frac{1}{2} (10)(18) \sin 120 \approx 78
\]

357 ANS: 3

\[
K = \frac{1}{2} (7.4)(3.8) \sin 126 \approx 11.4
\]

358 ANS: 3

\[
K = \frac{1}{2} (10)(18) \sin 46 \approx 129
\]

359 ANS: 3

\[
K = \frac{1}{2} (10)(18) \sin 57 \approx 604
\]

360 ANS: 2

\[
K = \frac{1}{2} (10)(18) \sin 120 = 45 \sqrt{3} \approx 78
\]

361 ANS: 3

\[
K = \frac{1}{2} (7.4)(3.8) \sin 126 \approx 11.4
\]
364 ANS:
\[ K = ab \sin C = 18 \cdot 22 \sin 60 = 396 \frac{\sqrt{3}}{2} = 198 \sqrt{3} \]

PTS: 2  REF: 061234a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: Parallelograms

365 ANS: 3
\[ 42 = \frac{1}{2} (a)(8) \sin 61 \]
\[ 42 \approx 3.5a \]
\[ 12 \approx a \]

PTS: 2  REF: 011316a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: basic

366 ANS:
\[ \frac{15}{\sin 103} = \frac{a}{\sin 42} \cdot \frac{1}{2} (15)(10.3) \sin 35 \approx 44 \]
\[ a \approx 10.3 \]

PTS: 4  REF: 061337a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: advanced

367 ANS:
\[ K = ab \sin C = 6 \cdot 6 \sin 50 \approx 27.6 \]

PTS: 4  REF: 011429a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: Parallelograms

368 ANS:
\[ \frac{12}{\sin 32} = \frac{10}{\sin B} \quad . \quad C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32} = \frac{c}{\sin 121.8} \]
\[ B = \sin^{-1} \left( \frac{10 \sin 32}{12} \right) \approx 26.2 \]
\[ c = \frac{12 \sin 121.8}{\sin 32} \approx 19.2 \]

PTS: 4  REF: 011137a2  STA: A2.A.73  TOP: Law of Sines
KEY: basic

369 ANS:
\[ 88. \quad \frac{100}{\sin 33} = \frac{x}{\sin 32} \cdot \sin 66 \approx \frac{T}{97.3} \]
\[ x \approx 97.3 \quad t \approx 88 \]

KEY: advanced
370 ANS:
\[
\frac{100}{\sin 32} = \frac{b}{\sin 105}, \quad \frac{100}{\sin 32} = \frac{a}{\sin 43}
\]

\[
b \approx 182.3 \quad a \approx 128.7
\]

PTS: 4  REF: 011338a2  STA: A2.A.73  TOP: Law of Sines
KEY: basic

371 ANS: 2  PTS: 2  REF: 061322a2  STA: A2.A.73
TOP: Law of Sines
KEY: modeling

372 ANS: 3
\[
\frac{59.2}{\sin 74} = \frac{60.3}{\sin C} \quad 180 - 78.3 = 101.7
\]

\[
C \approx 78.3
\]

PTS: 2  REF: 081006a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

373 ANS: 2
\[
\frac{10}{\sin 35} = \frac{13}{\sin B} \quad 35 + 48 < 180
\]

\[
B \approx 48, 132 \quad 35 + 132 < 180
\]

PTS: 2  REF: 011113a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

374 ANS: 1
\[
\frac{9}{\sin A} = \frac{10}{\sin 70} \quad 58^\circ + 70^\circ \text{ is possible. } 122^\circ + 70^\circ \text{ is not possible.}
\]

\[
A = 58
\]

PTS: 2  REF: 011210a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

375 ANS: 1
\[
\frac{6}{\sin 35} = \frac{10}{\sin N}
\]

\[
N \approx 73
\]

\[
73 + 35 < 180
\]

\[
(180 - 73) + 35 < 180
\]

PTS: 2  REF: 061226a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

376 ANS: 4
\[
\frac{13}{\sin 40} = \frac{20}{\sin M} \quad 81 + 40 < 180 \quad (180 - 81) + 40 < 180
\]

\[
M \approx 81
\]

PTS: 2  REF: 061327a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case
\[
\frac{5}{\sin 32} = \frac{8}{\sin E}
\]
\[
E \approx 57.98 \quad (180 - 57.98) + 32 < 180
\]

PTS: 2  REF: 011419a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

ANS: 2

33. \( a = \sqrt{10^2 + 6^2 - 2(10)(6)\cos 80} \approx 10.7 \). \( \angle C \) is opposite the shortest side. \( \frac{6}{\sin C} = \frac{10.7}{\sin 80} \)

\[
C \approx 33
\]


KEY: advanced

379 ANS: 4

\[
7^2 = 3^2 + 5^2 - 2(3)(5)\cos A
\]

\[
49 = 34 - 30\cos A
\]

\[
15 = -30\cos A
\]

\[
\frac{-1}{2} = \cos A
\]

\[
120 = A
\]

PTS: 2  REF: 081017a2  STA: A2.A.73  TOP: Law of Cosines

KEY: angle, without calculator

380 ANS: 1

\[
13^2 = 15^2 + 14^2 - 2(15)(14)\cos C
\]

\[
169 = 421 - 420\cos C
\]

\[
-252 = -420\cos C
\]

\[
\frac{252}{420} = \cos C
\]

\[
53 \approx C
\]


KEY: find angle

381 ANS:

\[
\sqrt{27^2 + 32^2 - 2(27)(32)\cos 132} \approx 54
\]


KEY: applied
\[
\begin{align*}
\mathbf{r}^2 &= 25^2 + 85^2 - 2(25)(85)\cos 125 \\
\mathbf{r}^2 &\approx 10287.7 \\
\mathbf{r} &\approx 101.43 \\
\frac{2.5}{\sin x} &= \frac{101.43}{\sin 125} \\
x &\approx 12
\end{align*}
\]

PTS: 6 REF: fall0939a2 STA: A2.A.73 TOP: Vectors

\[
\begin{align*}
\frac{27}{\sin 75} &= \frac{F_1}{\sin 60} \\
\frac{27}{\sin 75} &= \frac{F_2}{\sin 45} \\
F_1 &\approx 24 \\
F_2 &\approx 20
\end{align*}
\]

PTS: 4 REF: 061238a2 STA: A2.A.73 TOP: Vectors

\[
\begin{align*}
x^2 - 2x + y^2 + 6y &= -3 \\
x^2 - 2x + 1 + y^2 + 6y + 9 &= -3 + 1 + 9 \\
(x - 1)^2 + (y + 3)^2 &= 7
\end{align*}
\]

PTS: 2 REF: 061016a2 STA: A2.A.47 TOP: Equations of Circles

\[
\begin{align*}
x^2 + y^2 - 16x + 6y + 53 &= 0 \\
x^2 - 16x + 64 + y^2 + 6y + 9 &= -53 + 64 + 9 \\
(x - 8)^2 + (y + 3)^2 &= 20
\end{align*}
\]

PTS: 2 REF: 011415a2 STA: A2.A.47 TOP: Equations of Circles

\[
\begin{align*}
(x + 3)^2 + (y - 4)^2 &= 25
\end{align*}
\]

PTS: 2 REF: fall0929a2 STA: A2.A.49 TOP: Writing Equations of Circles
387 ANS:
\[(x + 5)^2 + (y - 3)^2 = 32\]

PTS: 2 REF: 081033a2 STA: A2.A.49 TOP: Writing Equations of Circles

388 ANS: 2 PTS: 2 REF: 011126a2 STA: A2.A.49
TOP: Equations of Circles

389 ANS:
\[r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13\]

PTS: 2 REF: 011234a2 STA: A2.A.49 TOP: Writing Equations of Circles

390 ANS: 4 PTS: 2 REF: 061318a2 STA: A2.A.49
TOP: Equations of Circles